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## **iPay.lk – A Digital Merchant Platform from Sri Lanka**

Parakum Pathirana,<sup>1</sup> Conrad Dias,<sup>2</sup> Thisan Samarasinghe,<sup>3</sup> and  
Shanmugarajah Sinnathamby<sup>4</sup>

iPay (Pvt) Limited, Sri Lanka

<sup>1</sup>amaranga@gmail.com; <sup>2</sup>conraddias@lolctech.com;  
<sup>3</sup>thisans@lolctech.com; <sup>4</sup>shanmugarajahs@gmail.com

**Abstract.** Mobile device ownership has increased across the globe making it the highest adopted platform. With the rapid technology advancements on the smartphones, improvements on the telecommunication networks, falling handset prices and reducing connectivity costs has resulted in mobile devices becoming the primary instrument which our daily lives revolve around transforming how consumers search, evaluate and procure goods or services. Payments are rapidly moving towards mobile while the commerce been transitioning to mobile. The recent developments in information communication technology has played a pivotal role in facilitating the modern digital businesses by reducing time required to perform transactions between buyers and sellers thus creating different customer behaviours. This new digital business paradigm has also resulted in making physical barriers such as distance and time irrelevant.

This paper presents an innovative digital merchant platform (including payments) currently been deployed in Sri Lanka. iPay is a novel solution that operates on the comparatively low cost of mobile devices to increase financial inclusivity in developing economies. One of the key challenges faced in such economies is that only a comparatively small population, concentrated in urban areas have access to banking facilities. There exists a vast potential in the much greater proportion of the population who are primarily engaged in agrarian based activities and cottage industries. The simplified nature of iPay allows this segment to be part of the banking system. iPay also enables the complete ‘digitalisation’ of merchants, with just a smartphone and an internet connection. This allows merchants to become part of a growing digital economy, and enabling other digital ‘strategies’ such as marketing campaigns to improve stock control and management, aiding merchants dealing with perishable goods. Cash accounts for bulk of financial transactions in Sri Lanka, which is primarily due to individuals’ not been able to access money in the banking system. iPay solves this problem by enabling access to funds ‘on-the-go’ which eases the burden of cash management on the economy as well as greatly reduces the risk of cash losses.

The nature of the iPay increases financial inclusivity, and helps to alleviate poverty by increasing employment opportunities across the economy. Major percentage of the population in developing countries have limited reach to credit, hindering their growth potential. Banks and financial institutes are unable to grant credit facilities, as they are not operating in the banking system, resulting in the inability to make a concrete assessment of a person’s credit worthiness.

iPay will be able to solve this by performing complex analytics on individuals' payment patterns in order to assist financial institutions calculate a 'credit index'. This availability of credit would greatly assist the rural population in developing cottage industries, which would in-turn provide employment as well as earn foreign exchange.

**Keywords:** mobile payment platforms, digital merchant, m-payments, mobile money.

## 1 Introduction

With the rapid growth of mobile telephone ownership, improvements on mobile phone hardware and increasing Internet connectivity has made mobile phones a vital part of our everyday lives. In this process, mobile phones have already replaced certain devices such as cameras, Satellite Navigation systems, music players, etc. Thus, mobile phones have reduced the need for people to carry multiple devices resulting in greater convenience and cost savings. The immediate reachability of the mobile phone has made it a commercially viable tool to carry out financial transactions [1]. Digitisation and automation of financial services resulting as proliferation of mobile telephony has been cited as one of the most significant developments during last two decades [2].

In early 2000, many enterprises expected their internet business to do well. However, they started to collapse due to shrinking profit margins and extremely competitive market forces [3]. With the learnings from the 'dot.com' bubble, businesses such as Amazon.com started selling electronic books, Blockbuster.com started selling digital movies to increase their profit margins by introducing digital business goods [4]. The creation of digital business goods has resulted in a paradigm shift changing merchants' business processes and customers' purchase activities while decreasing number of intermediaries involved greatly [4, 5]. Further, proliferation of mobile devices and social media has also contributed to the expansion of digital business goods market [6].

A white paper published by the European Commission in early 2000 has highlighted three key factors aiding in proliferation of new payments platforms [7].

1. Rethinking the product proposition from both marketing and technical perspectives

2. Staying away from creating a culture of fierce competition and creating the proper infrastructure at an acceptable cost for all the players

3. Creating predictable and efficient regulatory frameworks

In 2010, 'FinTechs' joined the competition as an emerging paradigm for providing efficient financial solutions [8]. FinTechs provide new financial service models and software applications implementing the new and efficient processes running on cutting-edge IT technologies thus competing with the traditional banking system [9]. Payment services offered by FinTechs encompasses the traditional banking services with added convenience, usability, security and higher efficiency.

Cash accounts for a staggering 85% of all financial transactions that take place across the world [42]. In the backdrop of these numbers, cashless payment methods are being increasingly encouraged and adopted across the island [43]. This includes the use of debit/ credit cards as well as the enablement of online payments for most utility services and fund transfers. The internet and smartphones are key driving forces behind iPay (the digital merchant solution/ payment platform explained in detail in section 4). These are two domains with a rapid growth in the recent past, both in Sri Lanka as well as across the world. Broadband penetration increased by 10%, whilst Mobile telephone connections increased by 10.2%, raising the islands' mobile penetration to 116.3% (end 2015). Total internet connections grew by 20.5% during 2015, largely supported by the rapid growth of 22.2% in mobile internet connections. Government initiatives also provided over 200 public Wi-Fi locations providing free internet access [43]. Further, Sri Lanka has been ranked as the cheapest country to own a mobile phone by the ITU [45] in terms of value, as per the Measuring the Information Society Report of 2015. ITU has also ranked Sri Lanka among the top five for all forms of the cheapest internet broadband prices.

These factors presents a completely new variety of opportunities to ensure the success of a product such as iPay. Financial inclusivity and Digital Payment enablement are some of the key concerns which iPay seeks to address. A considerable volume of Sri Lankan consumers and merchants reside outside the banking system, especially in rural areas. Most consumers and merchants still prefer to use cash for financial transactions. This results in the Central Bank of Sri Lanka annually spending millions of rupees to maintain the country's supply of physical currency. Adding to this burden are the problems in getting consumers to go 'cash-less'. Credit cards still require manual swiping and signatures. Non-cash transactions usually involve a nominal, but additional fee, which is ultimately passed on to the customer. All

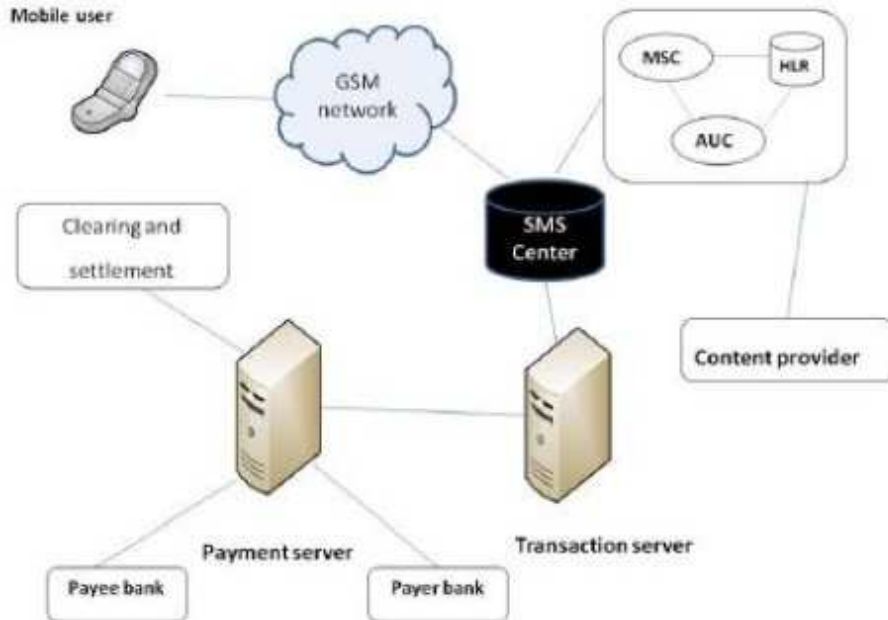
this combined with the risk-averse psychology of consumers have all become barriers in the journey towards a truly cashless society.

## **2 MOBILE PAYMENT PLATFORMS EVOLUTION**

In the section, a summary of mobile payment platforms covering pure SMS based payments platforms, USSD based payment platforms, WAP/ GPRS payment platforms, Mobile Application based payment platforms, SIM based application payment platforms, Samsung Pay payment Platform, Android Pay Payment Platform, Apple Pay Payment platform are discussed in order illustrate how payment platforms evolved over the years.

### **2.1 Pure SMS based Payment Platform**

Pure SMS based payment platforms allows to pay for goods or services by sending a text message from a mobile phone. The purchaser sends a text message via his/ her phone and the service provider clears the transaction between the purchaser and the vendor.

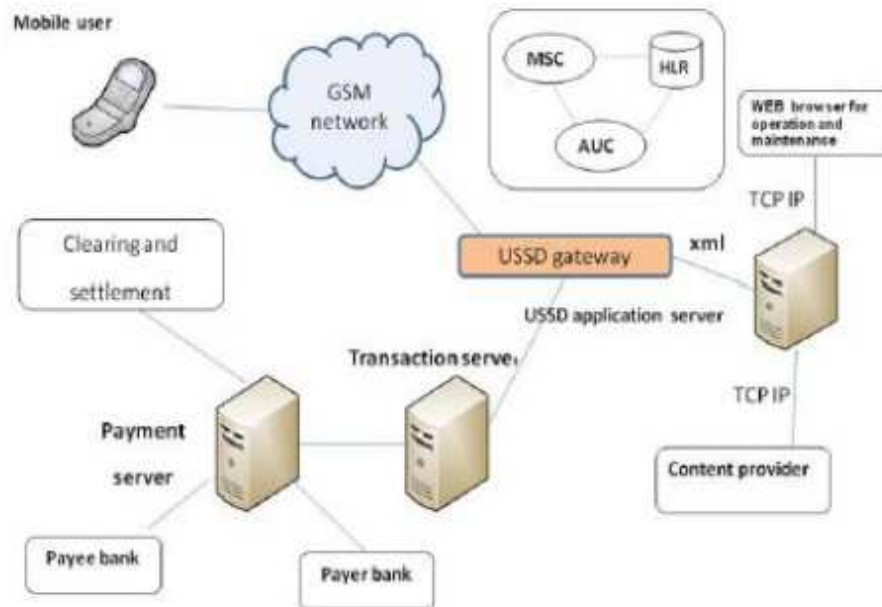


**Fig. 1.** Overview of the pure SMS based payment platform

As depicted in the diagram the transaction completes when the mobile user sends a standard text message containing the timestamp, random number, source account, destination account, amount, currency and the target mobile phone number to the payment platform [15]. The pure SMS mobile payment platform offers convenience features to customers including quick and easy use, absence of the need to remember passwords or install special applications. The platform connects millions or billions of new customers with the merchant at virtually zero cost.

## 2.2 USSD based Payment Platform

USSD is a protocol in GSM networks, which allows the transfer of information between the user mobile phone and the payment platform. This is facilitated by user entering a special code on his/ her mobile phone.

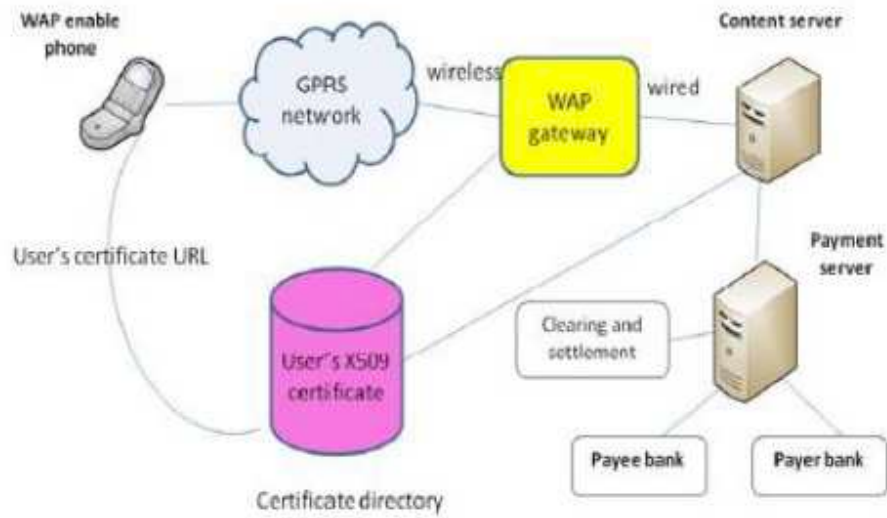


**Fig. 2.** Overview of the USSD based payment platform

As depicted in figure 2, the mobile user sends a USSD request to the USSD gateway, which spawns a session and re-route the session info to a specific application. The application forwards this info to the USSD gateway, which makes USSD messages and routes back to the mobile phone user. Bank interactions are done via the payments server with the facilitating banks [16]. Further, many telecom operators deployed USSD services to offer services such as free air time top-ups, thus incremental costs of adopting the same platform for mobile payments is greatly reduced [17].

### 2.3 WAP/ GPRS based Payment Platform

As illustrated in figure 3, the communications occur via the GPRS network through the user's WAP enabled mobile phone. The WAP gateway routes the user request to the content server. Similar to the USSD based platform, Bank interactions are done via the payments server with the facilitating banks. The mobile user is authenticated via a digital certificate [18].

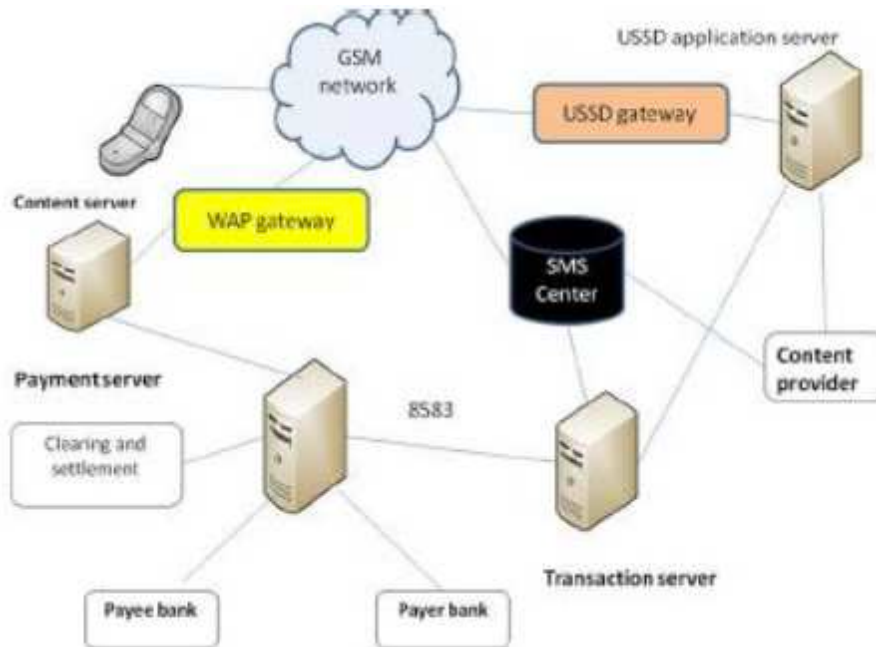


**Fig. 3.** Overview of the WAP/GPRS based payment platform

Services provided by WAP/ GPRS based payment platforms include web store purchases such as buying mobile entertainment content such as videos, audio, wall papers, games or ringtones which are generally charged to the mobile phone bill [18].

#### 2.4 Mobile Phone Application based Platform

As depicted in the figure 4, a special software is installed on users' mobile phone the payments will be carried through this.



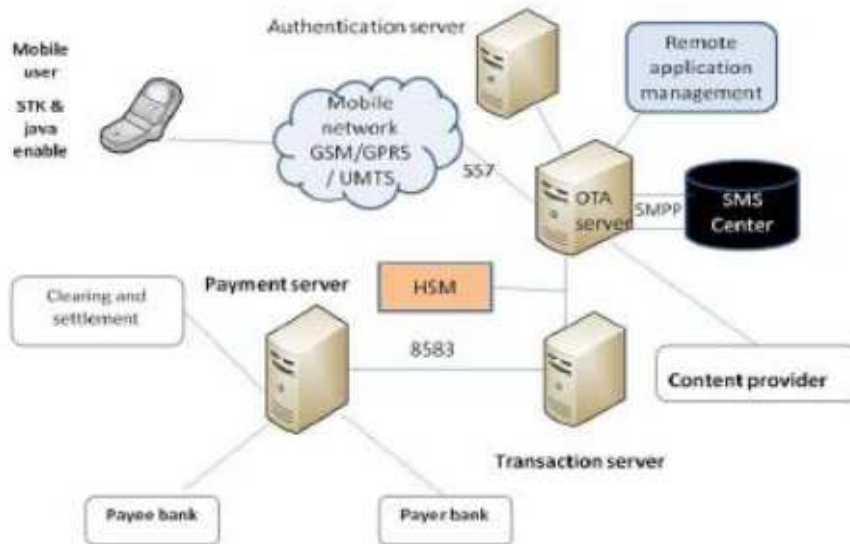
**Fig. 4.** Overview of the Mobile Application based payment platform

Once the user initiates the payment via the software installed on the phone, those instructions are transferred through a communication channel (SMS, USSD or WAP/GPRS) to the transaction server [19]. Security, cost and services available is correlated with the type of communication channel used [20].

## 2.5 SIM based Application Platforms

In contrast to the mobile application based payment platform, in the SIM based payment platform the application is stored in the SIM, instead of the mobile phone.



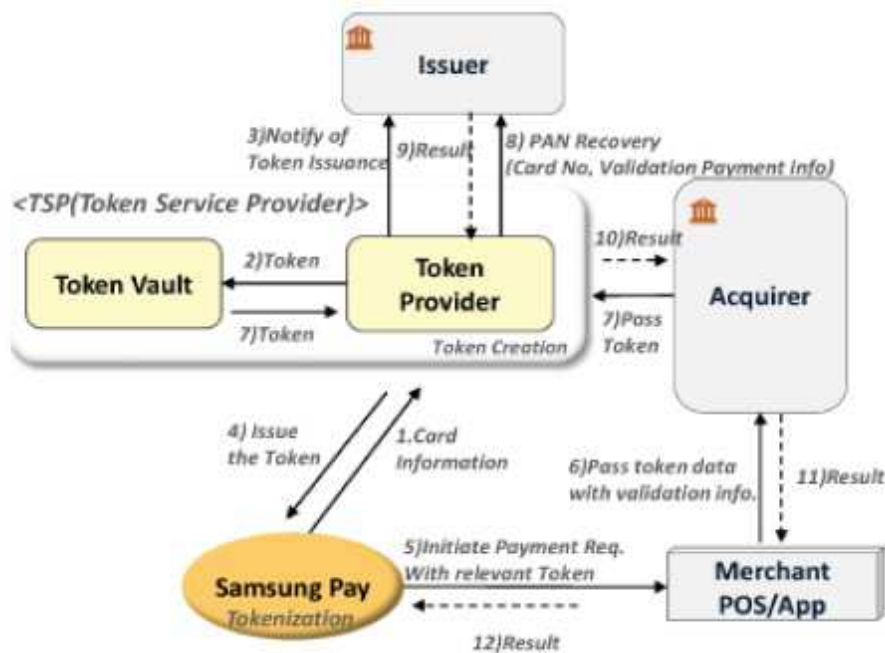


**Fig. 5.** Overview of the SIM based payment platform

As illustrated in figure 5, the user receives the application via the OTA server. This platform enables the user to send encrypted messages to the OTA server, which then decrypts them using the HSM module. Bank interactions are facilitated via the payments server with the participating banks [21, 22].

## 2.6 Samsung Pay Payment Platform

Samsung Pay offers tokenized transactions through NFC technology with tap-to-pay terminals and other magnetic stripe based terminals [33]. Samsung Pay uses a technology known as Magnetic Secure Transmission (MST), which emits a signal when a mobile phone is held against a compatible PoS machine simulating the magnetic stripe found on credit/ debit cards.



**Fig. 6.** Overview of the Samsung Pay payment platform

As illustrated in figure 6, when a user registers the card information, it is routed to the Token Service Provider in an encrypted form. After the card details are verified by the card company, the platform generates a token encompassing account data, which is sent to the users' mobile phone. This token is a one-time key, which cannot be re-used if it is lost or stolen [33].

## 2.7 Android Pay Payment Platform

Android Pay also uses tokenization. Tokens are generated in the cloud. Android Pay uses NFC to transmit payment instructions between the mobile phone and the PoS machine thus facilitating the contactless transactions [37].

## 2.8 Apple Pay Payment Platform

Apple Pay allows users to make payments over the web, via apps or physically in person. Similar to Samsung Pay, Apple Pay also facilitates the user to make contactless payments with the addition of two-factor authentication.

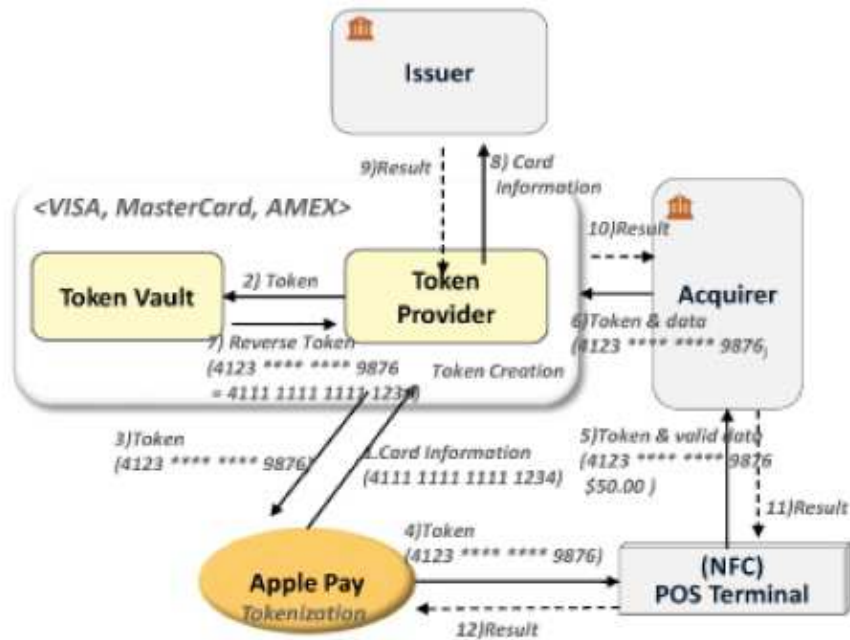


Fig. 7. Overview of the Apple Pay payment platform

Either, the user can manually enter the card details into the Apple Pay or he can scan the card. No card related information is saved on the phone, and it is encrypted and sent to the token provider. This is decrypted to determine the card issuer, and then it is re-encrypted with a key only a specific payment network can unlock. This information along with users' iTunes activity and device data is sent to the bank. Based on this, bank will either approve or reject the new card addition to the Apple Pay [32].

### 3 MOBILE PAYMENTS

#### 3.1 Solving a problem that does not exist?

The thought of paying for goods and services via the mobile is not a recent thought process [23]. Thus, many corporates realising the commercial potential launched commercial mobile payment platforms decades ago [24]. Mobile network operators envisioned this as means of generating additional revenue by providing value added services while banks (and other financial establishments) envisioned the potential of mobile payments to increase the use of electronic transactions enabling greater cost savings and new efficiencies [24]. Some researchers have gone into the depth of declaring mobile payment applications as the next killer-applications [25, 26, 46, 47].

However, certain researchers have been more sceptical about mobile payments applications and argued that mobile applications are trying to solve a problem that does not exist [27, 28]. Number of new mobile payment initiatives increased during 2000 with the introduction of Near Field Communicate (NFC), yet most mobile initiatives have failed despite few cases such as Osaifu-Keitai in Japan [29].

### 3.2 Engineering a successful Mobile Platform

There are multiple actors involved in a successful mobile platform. This is evident in modern successful payment platforms such as Alipay [30, 31], Apple Pay [32], Samsung Pay [33] and Android Pay [34]. The mobile payment platform can be visualized as a multisided platform as it involve more than one group of users: namely the consumers and merchants.

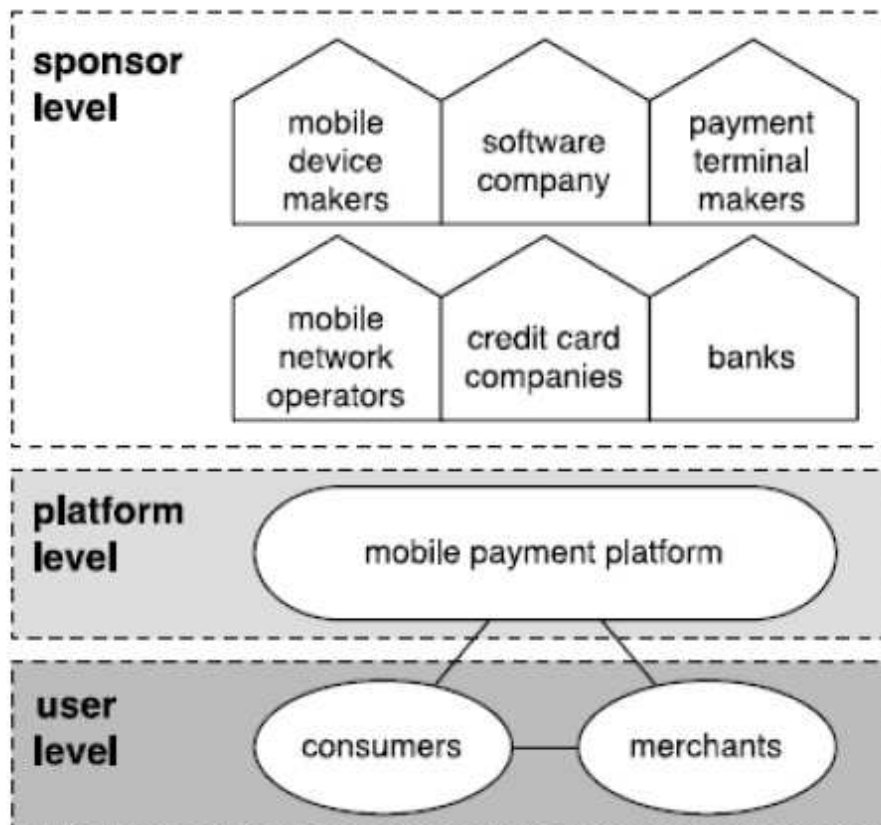


Fig. 8. Multisided architecture of mobile payment platforms [35]

As illustrated in figure 8, the mobile payment platform has number of actors (consumers, merchants, mobile network operators, financial institutions including banks, payment networks and service providers, mobile and PoS terminal manufacturers and other third parties such as trusted service managers) who are performing complex coordination's between different tiers (user level, platform level and sponsor level) [35]. The sponsor level exercises the property rights, determines the participants and develop the underlying technology stack while focussing on standardization and economics. The platform level functions as the primary point of contact of the users (covering both consumers and merchants).

The chicken-and-egg problem is one of the most crucial concerns for the mobile payments platforms [36]. The chicken-and-egg problem is simply the consumers may not wanting to join a platform without enough merchants and vice versa. This can be addressed by offering discounts to one or both sides or by leveraging on existing associations with other actors such as consumers who are already customers of mobile network operators and merchants who are already banking with existing financial institutions.

A research carried out in 2015 among four mobile payment platforms including Paybox, Mobipay, Postfinance and Moneta has listed following reasons as to why they failed [35].

- Malfunctioning collaboration
- No win-win business model
- Lack of support and promotion
- Inadequate technology and standards
- Low value compared to existing solutions

One of the biggest challenges faced by the mobile payment platforms is diverse industries with different views collaborating successfully and efficiently. The best example is the difference of opinion between the financial institutes and the mobile network operators. Establishing a win-win business model for all actors involved is further challenging, thus resulting in lack of support and promotion. Financial institutes do not want the mobile network operators to drive the lucrative mobile payments market, and they join only to keep some controls over the market. Another challenge is on the technology and standardization front: where consumers may not own a sophisticated device facilitating NFC enabled payment services and merchants may require new terminals for accepting payments. Further, users and merchants needs to be enticed to the switch to the new mobile payment platform. In order to do this successfully, key value added features should be there changing consumer behaviour in a positive way while encouraging the merchants to adopt the new payment infrastructure.

## **4 PROPOSED DIGITAL MERCHANT PLATFORM**

This section provides an overview of the payment ecosystems in Sri Lanka, and detailed account of iPay platform including how it delivers the intended benefits.

#### 4.1 Payment Market in Sri Lanka

Sri Lanka traditionally has been a cash based economy with some card-based transactions. The payments landscape is currently undergoing a slow transformation in Sri Lanka [38]. According to Master Card Survey Cash accounts for about 85% of global consumer transactions. Even in developed economies, still cash accounts for more than 50% of payments except in USA, which is around 35-40% [39]. Cash transactions accounts for 80%-90% in Sri Lanka and other Asian economies [40]. This is despite availability of debit cards, credit cards and POS's. Physical cash handling and cash management is a huge cost for the central banks and governments and Sri Lanka spends 5% of the GDP for the same [14]. Recently, the Indian government took steps to reduce physical cash by demonetising and promoting cashless digital payments. Sri Lanka has a population of over 21 million and the working population (above the age of 20 years) is around 7.9 million [38]. Further, the Sri Lankan banking system has over 18.4 million credit and debit cards as at 2016. Out of this, 17.1 million are debit cards and the rest are credit cards.

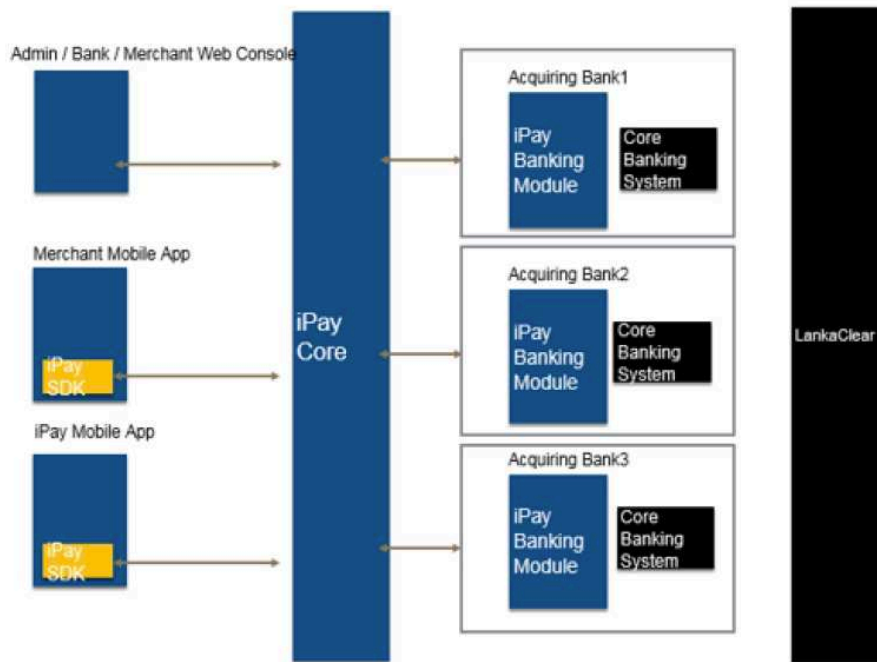
Sri Lanka has 1,019,681 registered business establishments (or merchants), out of which only 41,283 merchants accept credit/ debit cards. The implication is that only 4% of the merchants can accept cashless payments via 18.4 million credit/ debit cards in circulation. Thus, creating a mismatch in the use of debit cards as a payment mechanism. The iPay platform intends to address this shortcoming while fulfilling the cashless transaction ecosystem the government intends to have in 2025 [42, 45]. iPay is a platform that replaces the physical cash usage and brings frictionless transacting convenience to customer and bringing efficiencies to merchants and the entire banking eco system. Creating customer convenience by saving time spent on completing a certain task (such as making a payment) has become an overwhelmingly important consideration in mobile payment platform design [45].

#### 4.2 iPay Architecture

“iPay” is a mobile application which enables a user to link his credit cards/ debit cards/ savings accounts and current accounts, in a mobile application and securely make payments or facilitate other transactions. As opposed to traditional cash and card transactions, users simply “approve” the transaction on their mobile devices, from anywhere in the world, avoiding the hassle of counting cash and swiping cards.

The iPay technology is built to facilitate JustPay enabled services of LankaClear – the central cheque clearing house in Sri Lanka. An initiative that is aptly supported by the Central Bank and all the member banks of LankaPay Common Electronic Fund Transfer (CEFTS) to facilitate secure real-time retail payments below Rs. 10,000 under an extremely low tariff scheme. iPay is a robust solution built on a highly scalable architecture using state of the art technology, which would allow any type of merchant to offer iPay services, from Pavement Hawkers to Corner Stores, Coffee Shops to Super Markets and Super Stores to Department Stores. Anyone with a bank account, computer or smartphone and an internet connection can experience the fric-

tionless transactions via iPay. The high-level architecture of the iPay platform is illustrated below.



**Fig. 9.** iPay payment platform

As illustrated in figure 9, multiple acquiring banks are integrated with a single SDK in the mobile App and transactions occurring at each acquiring bank are routed to the Lanka Clears' JustPay network via the respective iPay banking module.

The world of physical cashless payments has been dominated by companies like Visa, Master and PayPal. Further, there are FinTech solutions such as Apple Pay, Android Pay, Stripe and so on. All these platforms are based on the existing payment ecosystem of Visa or Master Network. They add more layers of complexity and friction to the existing layers, resulting in increased transaction cost to the consumer. In comparison, iPay brings frictionless transaction capability at a fraction of the cost. The iPay platform reduces complexity to all stakeholders including customers, merchants and acquiring or partner bank, while allowing customers to register online with their existing bank account. Merchants do not require any special equipment nor complex process to register. Merchants receive their money to the account online real-time basis, with transactions fee amounting to 1 - 1.5%. Further, Real-time credit eliminates the reconciliation process. Banks can introduce credit without having to manage an ecosystem of plastic cards, but only having a current account with credit

facility, which could be facilitated by the iPay platform without any other intermediary software.

The iPay platform cater to all types of merchant from traditional pavement hawkers, in-store merchants, e-commerce merchants to digital merchants with InApp purchase experience. The platform further supports peer-to-peer payments for registered customers. The customer experience has been simplified through the multiple payment interaction options. The simplest and most cost effective being the ‘Scan & Pay’ through merchant QR Code scanning. The platform further facilitates ‘Tap & Pay’ via integrated NFC cards and ‘Discover & Pay’ via BLE beacons. Further, the platforms also support searching for merchants, adding as a favourite or locating based on the GPS location

## 5 DISCUSSION

One of biggest issues in providing credit to poor is the lack of documented credit histories [46]. The iPay platform can solve this problem by means of analysing existing data about consumers and promoting alternative credit evaluations mechanisms. Traditional credit evaluations mechanisms such as reference checks via credit bureaus or relying on monthly income statements is not viable options when assessing the credit worthiness of rural communities who have not been part of the formal banking system. Thus, new credit evaluations techniques such as analysing utility bill payment cycles, and his other expenditure patterns available on iPay platform can be used to carry out the credit evaluation. This will enable the banks to provide credit to poor at a much lower cost. iPay is aimed at facilitating transactions less than 10,000 LKR. Further, iPay can be used by merchants of various sizes, and industries. Even a pavement hawker can become a part of the iPay platform at nearly zero cost (the platform will provide him a smartphone free of charge, or he can even use non-smart phone also) enabling him to advertise his products or services on the iPay platform at no cost with very little technical know-how. Thus, the iPay platform can be used for digital enablement of conventional merchants. Since, there is no physical transfer of cash, the security aspects are covered. This is especially beneficial for small pavement hawkers/ shop owners/ fuel pumps who operate during night-time with inherent risks and challenges.

Another challenge for entrepreneurs/ start-ups in Sri Lanka is the lack of ability to accept electronic payments. The iPay payment platform can be seamlessly integrated with any of the existing mobile apps, websites with limited technical knowledge in matter of hours while giving better user experience to the consumer when making mobile payments (the iPay platform uses similar transition present in Facebook app, and Facebook messenger app). Thus, the consumer does not need to reveal his banking details to a generic app, providing him/ her better assurance on data. Similar to other countries, telecommunications and electricity infrastructure has penetrated further in the rural areas compared to the banks. The cost of transactions can also be lowered by adopting iPay platform. Hence, banking institutions can also leverage on



iPay platform to reach out to rural areas at virtually zero cost. Thus, banks can utilise the iPay platform to extend previously unbanked and low-income rural communities.

The iPay platform can also solve another common issue applicable to most of the banking institutions – how to keep the customers active. Compared to a traditional banking app, iPay is an eco-system comprising of various merchants and their portals. Merchants will push new offers, discounts via the platform, and based on the expenditure consumers will also earn reward points which can be redeemable via merchants. Thus, banks can use the platform to keep the customer engaged.

Another goal of iPay is to increase Digitalisation among Sri Lankan merchants. Since most merchants prefer to carry out cash transactions, this imposes a certain burden on the economy. Digital enablement would help reduce this overhead whilst facilitating real-time as well as easy cash management. This is not limited to payments, but merchants will be presented with a completely new range of digital ‘opportunities’ to promote and develop their businesses. These include awareness on special promotions, digital marketing campaigns and trend analysis as an input to business strategy. In addition, iPay can address challenges such as theft or robbery associated with collecting physical cash, especially in places such as fuel stations operating 24/7.

## References

1. Batchelor, S. (2008). “Mobile phone-enabled payment systems transformation 2008”, *Enterprise Development and Microfinance*, 19(1),13-30, doi:10.3362/1755-1986.2008.003, 2008
2. Shaikh, Aijaz A., and Heikki Karjaluo, "On Some Misconceptions Concerning Digital Banking and Alternative Delivery Channels." *International Journal of E-Business Research (IJEER)* 12.3, pp. 1-16. 2016
3. Kim, C., Kim, J., Lee, I. (2012). “Toward an evolution strategy for the digital goods business”, *Emerald Publication, Management Decision* Vol 50 No. 2, pp 234-252
4. Lang, K.R., Shang, R.D. and Vragov, R. (2009). “Designing markets for co-production of digital culture goods”, *Decision Support Systems*, Vol. 48, pp. 33-45
5. Williams, K., Chatterjee, S. and Rossi, M. (2008). “Design of emerging digital services: a taxonomy”, *European Journal of Information Systems*, Vol.17, pp 505-517.
6. Pathirana, P.A. and Azam, S.M.F. (2017). “Behavioural Intention to use Social Media among the Banking Consumers in Sri Lanka – An Empirical Study”, *European Journal of Social Sciences*, Vol 54(2), pp. 123-133
7. Lefebvre, P.J. (2000). “Digital Money – a view from the European Commission”, *European Business Review*, Volume 99 -4, pp 242 - 256
8. Mark, D. R., Verschur, E., Nikayin, F., Cerpa, N. and Bouman, H. (2015). “Collective action for mobile payment platforms: A case study on collaboration issues between banks and telecom operators”, *Electronic Commerce Research and Applications*, Vol 14 (5), pp. 331-344
9. Moon, W. Y., & Kim, S. D. (2016, October). A Payment Mediation Platform for heterogeneous FinTech schemes. In *Advanced Information Management, Communicates, Electronic and Automation Control Conference (IMCEC)*, 2016 IEEE (pp. 511-516). IEEE.
10. Investopedia, Retrieved on 28th Dec 2017 from <https://www.investopedia.com/terms/m/mobile-payment.asp>,

11. Fan, T.S., Beng L.Y. and Roslan, R. (2008), "Privacy in new mobile payment protocol", *World Academy of science, engineering and technology* 47
12. Tehrani, M.A., Amidian, A.A., Mohammadi, J. and Rabiee, H.R. (2010), "A survey of system platforms for mobile payment", *International conference on Management of e-Commerce and e-Government*, IEEE Computer Society, pp 376-381
13. MasterCard, Retrieved on 10th January 2018 from <https://www.mastercard.com/gateway/processing.html>
14. Pathirana, P.A., Azam, S.M.F. (2017). "Factors influencing the Use of Mobile Payments - A Conceptual Model", 35th National Information Technology Conference, Sri Lanka/IEEE Xplore Digital Library
15. Kim, C., Choe, S. and Choi, C. (2008). "A systematic approach to new mobile service creation", *Expert system with application*, Elsevier, pp 762-771
16. David, M. and Dawling, J. (2003). "State of the Art Review of Mobile Payment Technology", Trinity College Dublin, Department of Computer Science
17. Bourreau, M., & Valetti, T. (2015). *Competition and Interoperability in Mobile Money Platform Markets: What Works and What Doesn't?*.
18. Ho, H., Fong, S. and Yan, Z. (2008). "User acceptance testing of mobile payment in various scenarios", *IEEE International conference on e-business engineering*, IEEE Computer Society.
19. Mckitterick, D.A. (2003), "A Web Services Framework for Mobile Payment Services", Master thesis in University of Dublin
20. Kaplan, M., & Rand, C. (2005). U.S. Patent Application No. 11/125,833
21. Trichina, E., Hyppönen, K., & Hassinen, M. (2007, December). SIM-enabled Open Mobile Payment System Based on Nation-wide PKI. In *ISSE* (pp. 355-366).
22. Zou, J., Zhang, C., Dong, C., Fan, C., & Wen, Z. (2010, June). Mobile payment based on RFID-SIM card. In *Computer and Information Technology (CIT), 2010 IEEE 10th International Conference on* (pp. 2052-2054). IEEE.
23. Karnouskos, S. (2004). Mobile payment: a journey through existing procedures and standardization initiatives. *IEEE Communications Surveys & Tutorials*, 6(4).
24. de Reuver, M., Verschuur, E., Nikayin, F., Cerpa, N., & Bouwman, H. (2015). Collective action for mobile payment platforms: A case study on collaboration issues between banks and telecom operators. *Electronic Commerce Research and Applications*, 14(5), 331-344.
25. Rosingh, W., Seale, A., and Osborn, D., (2001). "Why Banks and Telecoms Must Merge to Survive", *STRATEGY AND BUSINESS*, pp 48-59
26. Zheng, X., and Chen, D., (2003). "Study of Mobile Payments Systems", *IEEE International Conference on E-Commerce*, pp. 24- 27
27. Smart Card Alliance (2003). "Contactless Payment and the Retail Point of Sale Applications, Technologies and Transaction Models"
28. TechCrunch (2012). "NFC is great, but Mobile Payments solve a problem that doesn't exist". <https://techcrunch.com/2012/06/30/nfc-is-great-but-mobile-payments-solve-a-problem-that-doesnt-exist/>
29. Flood, D., West, T., & Wheadon, D. (2013). Trends in mobile payments in developing and advanced economies. *RBA Bulletin*, 71-80.
30. Guo, J., Guo, J., Bouwman, H., & Bouwman, H. (2016). An ecosystem view on third party mobile payment providers: a case study of Alipay wallet. *info*, 18(5), 56-78.
31. Wee, W. (2012). China's Alipay has 700 million registered accounts, beats PayPal?. *TechinAsia*, available at: [www.techinasia.com/chinas-alipay-700-million-registered-accounts-beatspaypal/](http://www.techinasia.com/chinas-alipay-700-million-registered-accounts-beatspaypal/) (accessed 20 January 2013).

32. Hargrave, S. (2014). Apple Pay and iBeacons—A Digital Marketing Revolution Could Be on Its Way. *London Media Advertising Daily*, <http://www.mediapost.com/publications/article/233982/apple-pay-and-ibeacons-a-digital-marketing-revo.html>.
33. Kim, J. W. (2015). What is Samsung Pay. *Daum Cafe*.
34. Bhat, P., & Ramaswamy, S. (2015). Android Pay: The next generation of payments on Android. *Talk at Google I/O*.
35. Gannamaneni, A., Ondrus, J., & Lyytinen, K. (2015, January). A post-failure analysis of mobile payment platforms. In *System Sciences (HICSS), 2015 48th Hawaii International Conference on* (pp. 1159-1168). IEEE.
36. Caillaud, B., & Jullien, B. (2003). Chicken & egg: Competition among intermediation service providers. *RAND journal of Economics*, 309-328.
37. Android. Android Pay – It's not exactly magic, Retrieved on January 12th 2018 from <https://www.android.com/pay/>
38. Central Bank of Sri Lanka (2017), Annual Report 2016
39. Master Card Survey (2017). "MOST CASHLESS NATIONS OF THE WORLD, WHERE CONSUMERS STILL PREFER CASH DESPITE HEAVY FINES", <https://worldcore.eu/blog/cashless-nations-world-consumers-still-prefer-cash-despite-heavy-fines/>
40. Central Bank of Sri Lanka Road Map (2018). "Monetary and Financial Sector Policies for 2018 and Beyond".
41. BBC (2017). "India rupee: Illegal cash crackdown failed - bank report", Retrieved January 10th 2018, from <http://www.bbc.com/news/world-asia-india-41100613>
42. Business Times (2017), "18.4 mln credit/debit cards in use", August 27, 2017, Vol 25, No 20, pp I
43. Central Bank of Sri Lanka (2016). "Payments Bulletin Third Quarter 2016", [http://www.cbsl.gov.lk/pics\\_n\\_docs/10\\_pub/\\_docs/periodicals/payment\\_bulletin/2016/Payments\\_Bulletin\\_3Q2016.pdf](http://www.cbsl.gov.lk/pics_n_docs/10_pub/_docs/periodicals/payment_bulletin/2016/Payments_Bulletin_3Q2016.pdf)
44. PM's Office (2017), V2025 A COUNTRY ENRICHED, Retrieved January 10th 2018, from [http://www.pmooffice.gov.lk/download/press/D00000000061\\_EN.pdf](http://www.pmooffice.gov.lk/download/press/D00000000061_EN.pdf)
45. ITU. (2016, November 22). ITU releases annual global ICT data and ICT Development Index country rankings, Retrieved January 10th 2018, from <https://www.itu.int/en/mediacentre/Pages/2016-PR53.aspx>
46. Liébana-Cabanillas, F., & Lara-Rubio, J. (2017). Predictive and explanatory modeling regarding adoption of mobile payment systems. *Technological Forecasting and Social Change*, 120, 32-40.
47. de Luna, I. R., Montoro-Ríos, F., & Liébana-Cabanillas, F. J. (2018). New Perspectives on Payment Systems: Near Field Communication (NFC) Payments Through Mobile Phones. In *Mobile Commerce: Concepts, Methodologies, Tools, and Applications* (pp. 1487-1507). IGI Global.