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Emerging Technology Trends That Could Transform the Way Financial Transactions Occur

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Abstract
In this paper, we present the application of new Information and Communications Technology (ICT) trends in the financial industry, focusing on the advancement of value exchange through the use of Near Field Communication (NFC) technology and Mobile Point of Sale (POS) applications. We focus on their current impacts on the changing nature of money, the characteristics that make these recent ICT trends suitable to further influence the changing nature of money, their transactional models of exchange and project their future role as bedrocks for the emerging trends in the financial industry. We also briefly discuss the history of financial transactions, highlighting the different changes in trends that led to the present age and the stimuli that precipitated these changes
Keywords: Financial transactions, Contactless technology, Near field communication (NFC), Mobile point of sale (POS) applications, Electronic payments, Mobile payments, Electronic wallet, Mobile wallet

1. Introduction

Financial transactions take place as a result of a debt owed or for exchange of goods or offering of services between two parties. The invention of coin in 700 BC made it easier to pay debt and exchange goods (Yates, 2013), and with increase in the use and acceptance of paper money following its invention in 960 AD came a drastic reduction in the barter system of commerce (Sproul, 2001). However, paper and coin currency incurs high cost in production, operation, maintenance, security and availability logistics. For instance in 2012, the US new-currency budget was $747 million (Board of Governors of the Federal Reserve System, 2012), with the bulk of this cost shouldered by the government, through the central banks, and the other bit of responsibilities passed on to the commercial banks (Sproul, 2001).

The emergence of information and communication technology (ICT) in today's world is bringing about new ways of value exchange mainly because ICT trends are providing solutions to the challenges of paper and coin form of money. These challenges include logistics, transportation, transfers, liquidity and security of cash (Korinek & Sourdin, 2011). Electronic commerce (e-commerce) has made it easier for us to be able to exchange value without actually exchanging paper and coin currency. The advancement of ICT over the years has naturally led to the advancement of the various e-commerce media aiding the exchange of value. Some new technologies seem to possess natural ability in today's world to transform and further replace the exchange of paper and coin in transferring value between parties. This study explores technologies such as Near Field Communication (NFC) and Mobile Point of Sale (POS) applications and how they can affect the way financial transactions will take place in the future.

For this new ICT trends to be able to change the way we view money and perform exchanges, we need to identify the role of money in today's world. Money exists to serve as a medium of exchange, a unit of account and a store of value. For money to be able to fulfill those three functions, it needs to have the following characteristics; durability, portability, divisibility, uniformity, acceptability and be in limited supply (Money: Its Functions and Characteristics, 1994). We believe that for any media to successfully aid the transfer of the value that the paper and coin form of money has, such media should be able to support and naturally adapt to the basic characteristics of money. Any replacement media should also have solutions that are ubiquitous enough to tackle the challenges of logistics, transportation and transfers and also be mobile enough to engage the problems of liquidity. Security is another important feature as any replacement media should be secure enough to brazen out the current challenges of cash security.

2. Forward Looking Technologies

This study showcases technologies with natural characteristics that will promote the availability of electronic forms of payment. We reveal technologies that have the ability to confront the challenges of using paper and coin forms of money, and as well as support the basic characteristics of money. These technologies could be vital to increasing the use and importance of electronic money as we know it today. Near Field Communication (NFC) technology and Mobile Point of Sale (POS) Applications are two of such technologies; below is a quick

overview of these technologies.

2.1 Near Field Communication (NFC)

Near Field Communication (NFC) is a set of standards governing the establishment of radio communication between devices by bringing them close to each other (within a few centimeters) or touching them together. NFC technology can be used in areas like access control, consumer electronics, healthcare, data collection and exchange, loyalty and coupons, payments and transport (NFC Forum, 2013). Near Field Communication technology can capitalize on the indispensable nature of today's mobile devices to transform customer's smart phones into fully functional NFC devices (NFC – Future of Wireless Communication, 2011). Users can be able to wave their NFC enabled devices with the relevant application near an NFC reader module, allowing financial and non-financial transactions to occur (Amoroso & Magnier-Watanabe, 2012).

There is huge potential with this technology because consumers can be able to use their NFC enabled mobile phones to perform transactions; this is vital because there is increasingly huge dependence on smart phones in our everyday lives because of their portability, versatility and ubiquity. The transactions NFC enabled mobile phones can be able to perform includes spending on the high street, getting and using discounts vouchers (which holds same value as money) redeemable in store or on the go, ticketing and/or identification for the bus, train or access to event venues. Security for NFC payments is at worse the same as that of credit cards; however NFC is inherently more secure because of the physical distance constraint of a few centimeters for communication between NFC enabled devices. In the mean time, for high priced purchases or several purchases within a short period of time, the user is asked to manually enter a personal identification number (PIN) to ensure theft has not occurred (Near Field Communication | Android Developers, 2012).

2.2 Mobile Point of Sale (POS) Applications

A Mobile POS application is any software application on a mobile device that provides a checkout place, or a point through which a customer makes payment for debt or exchange of goods or services. This could also be the point where the merchant calculates the amount owed, and usually provides services for the customer to use in making payment (Investopedia, 2013). Modern mobile POS applications would work on most standard smart phones, and might have other functionality like inventory, financial and customer relationship management built into them. Some mobile POS applications can also be used to process card payments on other computing devices like desktops, laptops and tablets (Taylor, 2012).

There are a good number of Mobile POS applications already in use but the most popular ones are 'Square' and 'Intuit Gopayment'. Both solutions lets merchants turn their mobile/tablet devices into Mobile POS devices by attaching a plastic card reader and installing an app that lets users swipe their cards and process card payments. Small businesses can set up a one-stop shop via their mobile devices/tablets. Small merchants can then create a library of the items they sell, add a photo and price to each item, as well as create a favorites page for popular products etc. Sales analytics are also provided in real time, and sales reports and sensitive data are not accessible by all employees. Customers paying by credit card sign the receipt with their finger to validate the purchase, and merchants can text, email or print the customer's receipt (What is Square and how do I sign up, 2012).

There are also other variations of mobile POS applications called mobile wallets or generally, electronic wallets. An electronic wallet holds value by aggregating or loading funds from payment cards and are usually connected to mobile phones (or electronic accounts) equipped to use in settling transactions (Amoroso & Magnier-Watanabe, 2012).

3. Natural Transformational Characteristics of these Technologies

As stated before, the technologies that could transform the media with which transactions occur in the future must eliminate the challenges of the current media and alleviate the inconveniences associated with previous media. In this section, we present the advances of the above profiled technology and the way they provide better solutions to previous media (such as commodity money) challenges by revealing the manner in which each one handles the drawbacks of previous media.

3.1 Logistics

The operational cost, labor and resources put into the minting, circulation and regulation of bank notes and coins is quite enormous. According to the US Federal Reserve, approximately $747 million was budgeted for the minting of dollar bills in 2012 (Board of Governors of the Federal Reserve System, 2012), while other logistics statistics reveal that millions of dollars go into the regulation and circulation of this money among banks (Korinek & Sourdin, 2011). This is a lot of money that could yield better results if efficiently used to provide readers and other equipments to increase support for electronic settlement forms.

NFC enabled devices when used to transfer value between parties eliminate the process laden operation of printing and managing notes and coins. There is no such money production or circulation cost associated with NFC; it reduces the amount of money spent and the amount of paper use in financial transactions. Furthermore, it solves the cost and security challenges associated with carrying cash about among banks and even among

individuals. This is because of the enormous penetration rate of mobile phones in the world, these devices have become a part of our everyday life, and they are so ubiquitous and versatile that we can hardly do without them. According to International Telecommunication Union (ITU), the world penetration rate of mobile phones 96.2% in the world as at 2013 (2013).

The same goes for mobile POS applications, these applications reduce the logistics of printing money into the simpler logistics of authenticating, authorizing and approval of the transfer of value between digital bank accounts. Because these mobile POS applications can be made available in most smart phones, which are in turn becoming irreplaceable in our lives, we can say that these mobile POS applications posses the potential to be as ubiquitous as our smart phones. Thus, the adoption of these technology trends would drastically reduce the cost of money production, the security and the logistics associated with it. For instance in Japan where these technologies has been adopted for payment, about five years after the introduction of these technologies in the country (in 2001), the Bank of Japan started reporting decrease in the circulation of money in the country, starting with a 0.04 decrease in 2006 for the first time since 1971 and this decline in money circulation is attributed to the increase in the usage of technology based payment forms in the country (Yasuoka, 2010).

Moreover, the adoption of technology based payment forms increases the ease of performing financial transactions; information gathered from countries where Mobile POS applications have been adopted reveals that users are satisfied and is readily willing to use these applications. This is evident in the adoption and penetration rate of these technologies in these countries. For example, Japan with an estimated population of 127 million (CIA Factbook, 2013), has over 91 million users of Mobile POS applications with just a dozen years of introducing mobile POS applications (Amoroso & Magnier-Watanabe, 2012). Interesting data from the Japan Ministry of Internal Affairs and Communications reveal that with a Mobile Phone penetration rate of 87%, there are presently over 78 million mobile phone subscribers owning a mobile phone equipped with an Integrated Contactless IC Chip, and there are about 15 million active users of mobile phone-based mobile payment systems (Ezeli, 2009). Furthermore, according to the Japan Internet Commission (2009), about 92.9% of the population is aware of mobile phones capability to make electronic payments and 23% of these people host their electronic wallets on their mobile phones (Amoroso & Magnier-Watanabe, 2012). This data reveals the rate of acceptance, adoption, awareness and use of these technologies in Japan within about a decade of their introduction. This shows that customers are comfortable, confident and willing to accept these technologies, and merchants are willing to adopt or include these technologies in their payment systems. Hence, this information reveals that these technologies drastically reduce the cost involved with the logistics of carrying out financial transactions while increasing the ease of use of at the same time.

3.2 Transportation and Transfers

Transporting notes and coins, along with making sure they are available to everyone who has value and needs to transfer same is also an expensive overhead. Because these technologies are digital, the need for physical transportation of money to represent value is completely eliminated. The only transportation done is the movement of digital information (normally in bytes) which is relatively cheap and the speed of such transportation almost makes such information seem ubiquitous. For instance, records from the Board of Governors of the Federal Reserve (2004) show a huge difference in the cost of transferring through POS compared to Paper money. According to the report, the primary costs of accepting cash include transport costs, labor costs, security costs, merchant related expenses, exception handling costs, time taken to make and clear transfers, merchant third party costs and fees paid to depository institutions for cash-handling services. This when compared to the cost of using mobile POS application and NFC technologies is quite enormous. The Federal Reserve Bank of the US lists the costs associated technology based transactions to include: the merchant face value fee, the acquirer's fee, the interchange fee and network (switch) costs and the total cost of using this technology. In comparison, the cost for using technology based payment forms comes to an estimated $0.3 – $0.9 while the cost for using paper money to complete transactions come to about $1.3 – $1.8.

Also, report from the Federal Reserve of Arkansas city reveals that the amount of data communication used for mobile payments is very small compared to that for other activities, such as accessing a social networking site or sending and receiving text messages, photos, and videos unlike the hundreds of millions of dollars spent annually on transporting and securing mints cash all over the USA (Hayashi, 2012). In addition, the time consumed using these technologies cannot be compared to the amount of time used in carrying paper based money transactions. For instance, electronic payment forms would take 15 seconds to 30 seconds to swipe a traditional card, sign a receipt or enter a PIN and on the average well over 3 minutes faster that an over the counter, internet based and other paper based transaction models (Hayashi, 2012).

3.3 Liquidity

Liquidity refers to a characteristic of being able to easily convert to cash or in this case, value. In the present day, our phones are as mobile as we can be, giving us the ability to be able to carry our value with us. Mobile POS Applications provide electronic liquidity, storing value in the application used in performing electronic financial

transactions. This automatically eliminates the usual cost of providing physical liquidity for paper based money forms. In addition, the technology to covert electronic value to physical cash is already in existence and is provided through different media like the commercial banks, retail merchants, Automated Teller Machines and Mobile Agents. For instance in Kenya, 98% of M-PESA customers are satisfied with the liquidity facility of the Mobile payment system which is mostly carried out through retail agents and commercial banks (International Finance Corporation, 2011). Hence, this reveals the strength of these technologies to provide huge electronic liquidity and the potential to even satisfy cash liquidity.

3.4 Security of Physical Paper and Coin Money

According to the Federal Reserve Bank of Arkansas, Mobile payments have the potential to significantly reduce the likelihood of fraudulent POS transactions, this is because it facilitates dynamic authentication of the transaction at the point of sale (Hayashi, 2012). Card payments authentication technology in the United States has traditionally relied on static data, such as a card account number, expiration date, PIN, or signature. However, such data does not change from transaction to transaction which makes it easily used by criminals when intercepted. Meanwhile, a chip embedded in a mobile device can enable dynamic authentication, in which data unique to each transaction is used to authenticate the payment. This is the type of authentication technology NFC technologies and Mobile POS applications provide, the data of this type cannot be used to make fraudulent transactions, even if intercepted by a criminal (Smart Card Alliance, 2009).

Furthermore, these technologies provide a new layer of security by reducing the likelihood of fraudulent transactions through password protection of the mobile phones and the mobile payment application on the phone (Hayashi, 2012). This kind of password protection provides a new level of security not in previous technology or media. In addition, new forms of authentication, such as facial recognition are being introduced. For example, the payments startup 'FaceCash' created a mobile application that enabled participating merchants to view a photo of the consumer before approving a POS purchase (Hernandez, 2010). Other facial recognition software under development is aimed at providing more protection of the phone itself by requiring the user to take a picture of himself with the phone for verification (Etherington, 2011).

In addition, there exists a hardware based security feature in NFC enabled devices and in mobile POS applications that exists to protect the magnetic induction behind NFC transfers, secure data, authenticate identity and secure the transactions as a whole. The minimal functional features of the NFC platform as recommended by the US Federal Reserve requires all NFC enabled technology include dynamic data authentication, m-wallet contactless functionality and a secure element in the mobile phone (NFC Whitepaper, 2012). The secure element (SE) is a secure microprocessor that includes a cryptographic processor to facilitate transaction authentication and security, and provide secure memory for storing payment applications. This security feature supports other types of secure transactions, such as transit payment and ticketing, building access, or secures identification and ensures the security evaluation required for all transactions are confirmed before the transaction is approved.

4. Current Advances of these Technologies in Electronic Payments

In Japan, which is argued to be the most technologically advanced country in the world especially in the area of consumer electronics technology (Dan, 2011), Amoroso and Magnier-Watanabe confirms that a lot of consumers are quickly relating electronic payments with value-stored integrated circuit (IC) cards or mobile phones that could be waved in front of dedicated readers (2012). Ezeli (2009) reports that the Japanese ministry of Internal Affairs had released figures saying that Japan had about 78 million phone users owning a mobile phone equipped with an integrated contactless IC chip and further research claiming that 29.6% of respondents had contactless electronic money instruments and of that percentage, 81.75% used a contactless card and 31.75% used a mobile phone based contactless instrument.

Currently, but sparingly, NFC enabled devices can be used to pay for car park and check-in for flights. A mobile phone can be able to keep track of the time a driver enters and exits a car park, removing the need for parking attendants and paper tickets. Also, airline passengers can be identified and checked-in using ticket information stored in their phones (Amoroso and Magnier-Watanabe, 2012). The 'digital wallet' which is a more specific POS application that could hold value in the cloud and be accessible by laptops, tablets and phones, is beginning to gain footing in the developed world as well. These digital wallets are increasingly being used with as replacement or to aggregate payment cards (Carter, 2013).

NFC is also already making waves in Europe especially in the United Kingdom (UK); Jamie Carter (2013) reports in *Tech Radar* that Orange's 'QuickTap' scheme permits purchases of up to £15 at almost 50, 000 shops in the UK with the user just tapping their NFC enabled phones with POS applications topped up with payment cards. He also reports that feedback from users have been calling for inclusion of their popular loyalty cards and vouchers to the scheme.

Most of the reported advances of these ground breaking technologies as medium for exchanging value have been in the developed world, especially in countries that are known to be early adopters of technology. But even with

all these brilliant advances, the Bank of Japan (2009) still maintains that the value of cash in circulation is considerably larger than the value of electronic money. The report continues that electronic money services have not been able to have a huge impact on the payment or financial system yet. It seems highly unlikely that paper and coin money would be fully replaced soon, but nonetheless services that allow the exchange of value on the go are catching up and being highly encouraged (International Finance Corporation, 2011).

5. Future of NFC and Mobile POS Applications as Drivers of the next stage of Payments

Amoroso and Magnier-Watanabe maintains that success of any 'technology-based payment solution' would be determined by the ability of that solution to meet the needs of the consumers (2012). This claim is also embedded in the motivations that led to the invention of the paper and coin forms of money, providing a better way to pay for debt and exchange for goods and services. Consumer needs of settling debt and exchanging for goods and services are different today, therefore deploying the right technology and its model of application is important for the future of better servicing those needs. We could see a future where our wallets or purses along with most of their contents like paper tickets etc and maybe other contents of your entire pocket would live solely on your phone.

NFC holds its future in mobile commerce, electronic funds transfer and electronic ticketing and has great potential for the payment industry; this is because we could potentially be waving our smart phones at the checkout or over a display in a grocery store to pay, or bumping our phones with other phones or NFC enabled devices to share information relevant for payment. Steve Bills (2009) notices that there's been a steady transition from NFC enabled cards, to NFC tags that could be fastened to phones and now to the phones themselves having inbuilt NFC capability.

The immediate future points towards specialized applications being built for NFC enabled smart phones. These applications would be able to store payment card information and at the same time, activate the NFC capabilities of the smart phones, turning them into contactless payment cards. The practical applications phone based contactless payment mediums are unlimited, and they would be more secure than the debit and credit cards we currently use. Shahonya (2013) says that in comparison to the usual debit or credit payment cards that can be stolen, cloned and swiped at card readers by imposters, this new alternative offers improved security. The chances of on-air-transmission snooping are slim because NFC only works with a distance of less than four centimeters and possesses inherent and unique end-user encryption protocols and authentication levels that are superior to payment cards. He continues that for a stolen phone, the NFC chip can be disabled remotely by merchants or service providers, making it useless for payments.

We envisage mobile POS applications and electronic wallets working very closely with contactless electronic payment forms in the future. Electronic wallets being downloaded into mobile phone applications for use for payment would become more popular. In Malaysia, Credit card merchant VISA introduced the first service for consumers to be load their VISA cards into applications on their phones, and pay by waving their phones in front of a contactless reader in 2009 (Cellular News, 2009). The same service afforded Malaysians to be able to pay for city transport service, toll gates and car parks by waving their phones at contactless VISA 'payWave' NFC readers. We expect proliferation of such services and an expansion of 'waving to pay' to more areas where transactions occur to reduce payment processes and make payments more automatic.

In similar fashion, some public transportation providers in Japan are offering parents a way to be able to track their children's movements based on the use of NFC supported transport pass cards. Parents or other authorized persons will receive notifications containing their location on their phones each time their children touch through a ticket gate using their pass cards (Tokyo Security, 2010).

NFC would also be aggressively used in the future to drive sales and customer loyalty. Passive NFC tags could be put in shops, point of sale, and in other public places and could contain sales information, discount voucher, a map or a bus timetable that passers-by can touch their phones to receive (Carter, 2013). The future of Mobile POS applications is equally interesting. These applications will basically be looking to decentralize the concept of a 'point of sale' while minimizing time and the paperwork it takes to make a sale. Mobile POS applications on their own are looking to be involved in a lot of the processes leading to the sale, making shopping easier and more 'automatic' than it currently is. How Stuff works (2013) reports that in the Wagamama food chain for instance, mobile POS applications have made their way into the entire process from recording the order, which is immediately displayed to the chef after being inputted, to printing the ticket that tells the waiter where to deliver the food. After the meal, the debt is cleared by the consumer using the mobile POS application and receipt is printed or emailed. Consumers can download the Wagamama POS application and can be able to order and pay for their food before going to the restaurant to either eat there or take the food out.

In Japan, NTT Docomo and Seven-Eleven Japan started a service that let consumers receive their phone bill statements directly into their mobile wallet application, and also gave the consumers the possibility of clearing those bills by holding their phone over the card readers set up at local Seven-Eleven stores (Seven Eleven Japan,

2009). As mobile wallet applications become increasingly popular, this model can become a better and more efficient way to handle bill payments. All bill payments like electricity, gas, water, phone and even government taxes and bills can be routed directly to your account on an electronic wallet and settle upon the authorization from users from their mobile phones.

In the same direction, we see future mobile POS applications personalizing the shopper's shopping experience a lot better. Businesses will increasingly see the need to build applications with POS functionality that can be used to attract more sales by offering discounts and coupons based on the consumer's usage, shopping history and proximity (Neumann, 2010). Consumers would be tempted to buy more if they are given a better deal, and Merchants see these applications are a good media to advertise their deals.

Also, the current basics of supply chains are currently being transformed, and this transformation will be pushed even more in the future by emerging mobile money technologies. For example, Coca-Cola is turning to the use of mobile money mechanisms to shift its manual distribution centers away from cash (International Finance Corporation, 2011). With stakeholders involved in the biggest supply chains leaning towards these emerging mobile money trends, transactions involved in the production of products would in the future be done completely with the use of emerging mobile money technologies.

6. Conclusion

In summary, we believe that these emerging mobile technologies would strongly and rightly affect the way transactions occur and the manner value is stored and exchanged in the future. Evidence from different demographics across the world has showed that these technologies inherently possess the potential to change the payment culture and precipitate a new trend in value exchange. We believe that within the decade, considering the amount of money being invested in these technologies, and the rate of adoption shown from recent reports, these technologies would effectively compete with paper money and reduce the amount of paper and coin circulating in the financial system. We also have to add because these technologies offer a more transparent and cost effective way in exchanging value, adoption of these technologies presents a strong case for governments and businesses as well.

In the future, it would be important to investigate the growth and adoption rate of these technologies, the corresponding impacts as well as the strengths and challenges they pose to different merchants and customers in the different parts of the world in order to project the pattern of their adoption and spread. Demographic tailored research and survey would be carried out in notable early technology adoption countries in Africa like Kenya, South Africa, Egypt, Tanzania, Nigeria and Ghana to cover the major regions of the continent.

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