The economies of scale effect in adopting mobile payment solution: a case study in Malta

Timothy O Tonwuru
Institute of Information & Communication Technology
University College
MCAST, Paola PLA 9032
{timothy.tonwuru.b4231}@mcast.edu.mt

***Abstract*—Improved and advanced technology has made it easier for present day transactions to be carried out with the use of smart phone. This project aim to take advantage of this to study if adopting mobile phone payment in the Maltese economy can reduce the amount of cash used in payment transaction and thereby bring about economies of scale and increase production. A qualitative analyses will be carried out in order to propose a low cost, durable, efficient and secured tailored made mobile payment solution for the Maltese market. Based on the analysis, a decision would be made on either to use Near Field Communication (NFC) Technology or QR-Code Scanner. The solution would be supported with the use of the present day technology such as React Native Framework, ASP.NET Framework, Microsoft SQL Server and any other technology used will be referenced in the paper.**

***Index Terms*—Near Field Communication (NFC); QR-Code Scanner; cash payment; mobile payment; economy of scale; qualitative**

I. Introduction

Transaction all over the world is turning cashless due to electronic means of payment which could be either e-commerce (online transactions) or through direct contact between the customer and merchant by the means of payment card. This area of study is specific to Maltese marketplace by looking at how the adoption of mobile payment can be used as a driving force to reduce the amount of cash payment transaction and thereby bring about economies of scale in all aspect of the Maltese marketplace, through the use of either Near Field Communication (NFC) or QR-Code Technology. The main area of study will encapsulate several aspect such as this introduction, followed by literature review, research methodology, evaluation of result and finally the conclusion. This research will entail a qualitative analysis by understanding why the use of cash payment is predominant in the Maltese market place and what is hindering the marketplace to shift to electronic or digital payment like other European Countries.

Based on the result of the qualitative analysis, a prototype mobile payment solution will be developed by connecting it directly with customers financial fund account. The prototype will take advantage of either Near Field Communication (NFC) Technology or QR-code Scanner Technology, which will be used to capture payment details as well as a based to create an efficient, fast, reliable and secure transaction. This will be the driving force to try to shift retail transaction from predominantly cash payment to electronic mode of payment in the Maltese marketplace. This will bring about economies of scale to all aspect of the retail sector. The study will look into which existing technology such as Near Field Communication Technology (NFC) and QR-code Scanner Technology will be cost effective in producing the prototype.

The prototype involves a registered customer using the prototype application in a smart phone which would be used to scan a QR-Code or NFC tag of a merchant, selecting which customer fund account at a financial institution to use for the transaction, authenticate the customer, perform some checks through the application methods, approving the transactions if sufficient fund is present and finally debiting the customer account with the financial institution while crediting the merchant account at the merchant financial institution.

My motivation for this project is born from the fact that most retailers in Malta do not have electronic means of payment compare to other European countries such as France, Germany, Italy, United Kingdom and many others, thereby giving one no option than to carry cash around. In France for example, electronic payment are available nearly everywhere, starting from newspaper outlets, fuel stations, grocery stores, clothes shops, bus and metro terminal, mini markets as well as supermarkets and many more. In France for example, electronic payment can be used to buy as low as 50 cent (0.50 EUR) of a Euro of a bus or metro ticket at the ticket terminal.

I got more interested in my choice after being giving admission to at MCAST College University to pursue a career in Software Development, knowing fully that I would be taught the necessary technology needed to built such payment solution. A survey and annual report called An Analysis Of Maltese Payment Habits by the Central Bank of Malta which was published in 2014, shows that 80 percent of the volume of transactions were cash payment. To buttress this point further, the European Central Bank published a report that shows that the highest amount of cash payment in the European countries were recorded in Greece, Cyprus and Malta, which shows that over 70 percent of transaction were carried out in cash. To speed up the adoption of cashless society in the European Union, Payment Service Directive 2 (PSD2) was introduced. This directive became active in 13 January 2018. One of the purpose of this framework is for European Union financial entities and financial technology companies to come up and

create a unified financial and payment system that will boost the European Union economic activities in order to create a cashless, fast, efficient and secure financial and transaction process and environment.

In order to determine the right payments solution to counter the use of cash payment, the data derived from the qualitative analysis in respect of this project will be collected in the Maltese marketplace and such data would come from customers, merchants and the financially institutions. Since this study involves financial transaction, there will be several questions from the stakeholders. One of such question I have envisage would be on security and efficiency. Apart from the question envisage, this study will try to answer three hypothetical questions as follows: whether or not the proposed mobile payment solution would bring about reduction in the amount of cash transaction in the Maltese marketplace? Would it translate to economies of scale and finally, would it be efficient and secure? This study is not predicting that cash payment would be totally eradicated, as not everyone, especially the elderly know how to use the smart phone and for this reason, conventional mode of payment such as cash payment would still be in use.

The project if successfully, will create a conducive market place ecosystem where any amount of transaction as little as 10 cents of a Euro (0.10 Euro) can be carried out using the application to be proposed which will be efficient, reliable and secure. Finally, The study will target consumers, retails/merchants, financial entities, and small and medium businesses as a means for the qualitative research as well as testing the final prototype.

II. Literature Review

The creation of technology and the internet has made it simpler for business to be transacted both through online and at retail point such as Electronic Point of Sale (EPOS). After this, the smart phone era was born and it even made it simpler for transaction to be carried out by using a smart phone. Improve technology is behind the present day different payment means, such as electronic payment using either a debit or credit card. Since the introduction of smart phone, mobile payment applications have been gaining momentum. This led to the creation of technologies that enhanced smart phone to communicate better together. Two of such technologies that I will be writing about that concerns this project are Near field Communication Technology (NFC) and QR-code scanner Technology. This two technology have made it easier for the smart phone to be used as a means of making fast payment.

NFC Technology is embedded in electronic device and smart phone to transfer or communicate data from one phone to another. NFC Technology was born out of Radio Frequency Identifier (RFID) Technology. RFID was patented in 1983 titled Portable Radio Frequency Emitting Identifier (Charles A. Walton, 1983). In his patent document, he stated and I quote It is becoming increasingly necessary to quickly and accurately identify people or objects located at a terminal remote to a central processing station, end quote. Also in his abstract he described RFID as follow: An automatic identification system wherein a portable identifier, preferably shaped like a credit card, incorporates an oscillator and encoder so as to generate a programmable pulse position-modulated signal in the radio frequency range for identification of the user. From this, one can deduce that RFID made transfer of data faster between electronic devices and of interest was the mention of credit card which is related to transaction.

RFID was built upon after the first patent and several scholars did additional work to finally come up with NFC. Such work can be seen in a patent titled Communications devices comprising NFC Communicators (Heikki Huomo et al, 2013). It was stated in their patent paper that near field RF (radio frequency) communication is becoming more and more commonplace as is the use of such technology to transfer data. This shows that NFC is becoming the choice for fast data transfer between near devices. In the paper it was envisaged that this technology will play a major role in financial transaction and I quote One application area is the financial transaction area which involves payment for products such as goods and services, end quote.

The emphasis of NFC on mobile payment can further be noted in Near Field Communication (Kevin Curran, et al, page 2, 2012) where it was stated that as users need for technology increases, it makes sense that another function to add would be the ability to use the device to make payments, and that is where NFC comes in. This can also be seen in the work done by Helena Rodrigues et al (2014), where it was stated that mobile payments have become a major focus for commercial and research activities in recent years.

Despite the fact that NFC is fast, it comes at a cost as NFC tag devices are expensive to produce. For this reason this paper will be looking into another technology used in mobile payment referred to as QR-code scanner technology first developed by a corporation called Denso Wave in 1994. Taking reference from Comparative study of Barcode, QR-code and RFID System (Trupti Lotlikar. et al, 2013), it is stated that the QR-code scanner in the mobile device contains an illuminator, which is a red light that runs across the screen when the application is open. The sensor with the aid of the camera and the decoder then work together to decode the QR-code which contains some information. This information could be a link, a picture, a video or a customer or merchant information which can be used during payment transaction.

Additional significance that QR-code Technology has been playing in the payment industry can further be seen in a patent titled QR Code-Enabled P2P Payment Systems and Methods (Don W. Tyler, et al, 2017). In their work, it was shown how data can be carried in a QR-code and be used in a financial transaction. It was further explained in the patent that the method used involves displaying the QR-code on the display of one mobile device for the purpose of scanning by a second mobile device. Lauren Elmore and Derek Stephens (2012) described it in their research as a 2D barcode that encode and decode data at a rapid rate and can be read with software input on to a mobile device with pre-installed camera.

One significance of this technology is that a customer or merchant information can be encoded into a QR-code by using any of the available QR-code generator which has be tried and tested which are free and readily available online without any cost. The use of QR-code in relation to mobile payment as a fast means of scanning information has been illustrated in numerous academic research, journals, papers and magazines. Mobile payment penetration has reached 64.7 percent of the population in China according to report and also of the three major payment methods Unionpay cards, NFC (Near Field Communication) and QR codes, it is stated that the last one is sweeping the market (Caixin Weekly, 2017, featured in China Today news). More information can be read in related materials sections at the bottom of this study.

This dissertation will use qualitative research through questionnaire delivered to the consumers, merchants and financial institutions in order to deduce the most appropriate and efficient technology to use that will be cost effective in order to produce the appropriate payment solution that will be beneficial to consumers, merchants and financial institutions in order to derive meaningful economies of scale. The qualitative survey will be in the form of questionnaire both for online and direct survey for those that are not familiar with online questionnaire.

III. Research Methodology

In order to determine which of the two technology to use as mentioned in the literature review above, I have based my analysis partly on the secondary data as explained in the introduction section carried out by the European Union and the other carried out by the Central Bank of Malta. Both survey showed that cash payment is the predominant mode of payment in the local market and gave an indication that over 70 percent of transactions were carried out in cash. On the other hand, I carried out a qualitative analysis to understand the underlying factors behind why the Maltese marketplace have not moved to electronic payment. The analysis will enable me understand and choose which of the underlying technology to use between Near Field Communication (NFC) Technology and QR-Code Scanner Technology to build the target mobile payment solution.

A qualitative analysis in the form of a face to face questionnaire targeted the market players which are the Merchants, Consumers and Financial Institutions (Banks). Because the market players are so large in scope and the time constraint involved, I chose a few of these market players in order to aim at the goal of this research which would be further developed and enhanced in full in my final year project. The merchants are partly the predominant factor that determine the type of payment solution to offer at their outlets and based on this, my qualitative analysis targeted niche merchants as they account for majority of transaction offered in cash. The sixty merchants I interviewed came from ten each of Pastizzi/Pastizzerija shops, known also as Maltese snack shops, petrol stations, confectionery shops, coffee shops, restaurants, and grocery and vegetable shops. The second group I interviewed are sixty consumers which comprises of different shoppers including students and the final group are 3 different official from 3 financial institutions. 90 percent of the merchants interviewed do not have electronic payment system and 96 percent out of this said their reason was because of the overhead cost and charges that comes with them. 10 percent of the merchants have electronic payment but only allow it for transaction amount over 10 Euro and the reason given is because of the overhead cost and charges involved. As for the 60 consumers interviewed, 98 percent said they will try any electronic payment which offers to allowed transaction payment as low as even 10 cent of a euro in order for them not to carry cash with them while 1 percent were elderly customers that do not know how to use a smart phone. Finally, the 3 official interviewed all said they will accept any electronic payment that is accepted by their clients both merchants and consumers which could make it easier for them to carrying out payment transactions.

With the above analysis at hand, I came to the conclusion that the market is driven by cost effective application, as well as an application that allows little amount of transaction to be carried out with the merchant without the merchant putting a limit on how much has to be spend before such application can be used for payment. Based on the above analysis, I concluded that the mobile solution could only be built by using QR-Code Scanner Technology as to be cost effective for every party. Though, the Near field Communication (NFC) is faster in preforming transactions according to research stated in the literature section, nevertheless, there are extra cost involved in producing a near field tag for merchants which would increase the merchant overhead cost, thereby defeating the purpose of this research if used.

The proposed application is being built using QR-Code Scanner Technology for reason stated above and the purpose is to capture merchant or customer information on a QR-Code either through the smart phone or through a hard copy print of the merchant QR-Code. The other technology used to complement the development of the application are React Native Framework for the front-end which is based on Java Script, ASP.NET Framework for the back-end and Microsoft SQL Server as the database engine. A sketch of the front-end frames are provided in the diagram section. The proposed application do not use a card payment system but rather tap directly into the customer account at the financial institution the customer is registered with. For this to be successfully, the financial institution have to implement the application API (Application Processing Interface) or I have to implement the bank API to have access to the client account through the application and this is made possible because of the Payment Service Directive 2 (PSD2) enforced by the European Union. The application test process would involve the following:

o A customer and a merchant would be required to download the application into their smart phone.

o During registration process, the users would be ask to connect to their respective funding account or bank account.

o The process would ask the users to open a secondary

account which will be called e-account.

o If the e-account is founded directly from the primary account of the user, such e-account would be called a Debit E-account, else, if it is founded by the financial institution, it will be called a Credit E-account.

o Every user registered would have a registration code or identification number.

o In the case of the merchant, this identification number would be used to generate either a QR-code.

o During a transaction, the customer scanned the QR-code of the merchant.

o This brings up the merchant details and a box to input the amount to be paid.

o The customer entered the amount and presses a pay or submit button.

o Validation would be done through some processes and methods to ascertain if the customer has enough fund.

o If there is not enough fund, the transaction would be rejected or cancelled.

o If there is enough fund, the transaction would be approved and the merchant would immediately receive a message on the merchant application.

o Merchant receiving account information would be passed on to the customer fund managing institution for onward transfer and crediting of merchant account.

IV. Project Evaluation

This project is still on going and not yet in complete.

V. Conclusion

This project is still on going and not yet in complete.

Appendix A
Supporting Material

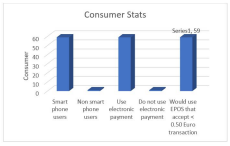

Fig. 1. Consumer Stats

Fig. 2. Merchant EPOS Use

Acknowledgement

Work in Progress

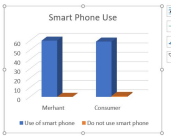

Fig. 3. Smart Phone Use

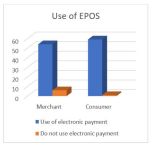

Fig. 4. EPOS Use

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Related Materials

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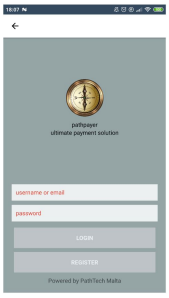

Fig. 5. Login Screen

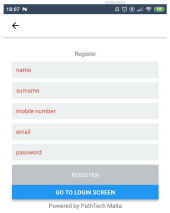

Fig. 6. Register Screen

Point of Sale: Current Market and Future Prospect. Copyright of Research Review is the property of Federal Reserve Bank of Boston.

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