INITIAL RESEARCH PROPOSAL FORM

(also referred to as 'Statement of Intent Form')

To be submitted by the researcher to the Institute Research Sub-Committee (IRC)

Research Title: The economies of scale effect in adopting mobile payment solution: A case study in Malta.
Institute name **MCAST: ICT Institute**
Course / Programme: **Bachelors of Science (Hons.) / Software Development**
Level and year of study **Level 6.2B 2018/2019**
Main area of study being proposed: The main area of study will encapsulate several aspect as detailed below. This study 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. This study will also look into how mobile payment solution, using the past and present technological advancement, can be used as a driving force to reduce the amount of cash payment transaction in Malta economic system and thereby bringing about economies of scale in all aspect of the Maltese marketplace. 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 Technology – NFC 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, performing 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. 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.

Name of Researcher:	**Researcher's I.D. Number:**
Timothy O. Tonwuru	**26004A**

Signature of Researcher	**Date of submission of Form**
Name of Tutor (or Recommended Tutor): Simon Attard	

Personal Motivation for the Choice of Research Theme.

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 reading survey and annual report called An Analysis Of Maltese Payment Habits by the Central Bank of Malta.[1] This report was published in 2014 and it shows that 80 percent of the volume of transaction 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.[2]

To further throw more light into my interest in this sector, the European Union introduced PSD2 (Payment Service Directive 2).[3] This directive became active in 13 January 2018. One of the purpose of this framework is for European Union financial entities and fintech companies to come up and create a unified financial and payment system that will boost the European Union economic activities in order to create fast, efficient and secure financial and transaction process and environment.

Outline of Key Literature and Theoretical Framework or Propositions.

The creation of technology and the internet as made it simpler for business to be transacted both through online and at retail point such as 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

[1] Central Bank of Malta - https://www.centralbankmalta.org/file.aspx?f=11227.

[2] European Central Bank - https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op201.en.pdf

[3] European Union - https://ec.europa.eu/info/law/payment-services-psd-2-directive-eu-2015-2366_en

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 barcodes that encode and decode data at a rapid rate and can be read with software input on to a mobile device with preinstalled 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.

Significance of the Study.

Considering the fact that mobile payment solution has not taken off in Malta, the significance of this study is to be able to reduce the amount of cash transaction in the Maltese marketplace by encouraging the target participants to be involved to use the application that will be proposed, while on the other hand reaping cost advantages for both the merchants and the financial institutions. This will create a conducive market place eco system 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.

This solution to be proposed will hope to greatly reduce overhead cost for merchants, as they are the driving force to determine whether to offer any means of payment solution to the customers. Though there are other means of electronic point of sale solution in Malta, such as EPOS using plastic payment cards, nevertheless, this comes as a cost to the merchants as they are not willing to part away with portion of their revenue and also there are over overhead expenses involves in putting such payment system in their domain, thereby merchants prefer to accept cash payment.

In order to determine the right payments solution to counter the use of cash payment, the data derived from this qualitative analysis 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. Also, 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.

Hypotheses and/or Research Question/s

The hypothesis considered for this research are:

- Will mobile payment solution reduce the amount of cash transaction in Malta retail sector?
- Will there be any economies of scale benefit to merchants?
- Will the propose solution be efficient and secure?

Target Participants and Research Methods for Data Collection and Analysis

- Some research data have already been conducted and published by the Central Bank of Malta and European Central Bank as stated and referenced earlier in this research. The survey already pointed out the issue of the use of cash payment predominately in the Malta marketplace. This information will be used as a source of secondary data.
- In additional to the above secondary data published, a brief research data will be collected from online questionnaire and as well as direct survey from participants who do not have access to online questionnaire in order to determine the approach and what kind of mobile payment solution would be proposed and implemented.
- The research will focus on consumers, financial institutions and in particular, retailers, merchants and niche markets or businesses where cash payment is mostly used as the business entities determine the mode of payment.
- The participants involve will include some the following possible entities:

- Consumers.
- Merchants:
  - Petrol stations
  - Pastizzi / Pastizzerija shops (Maltese snack shops)
  - Ice-cream shops
  - Confectionery shops
  - Bazars
  - Coffee shops
  - Grocery and vegetable shops
  - Restaurants
  - Photocopy shops
  - Souvenir shops
  - Handyman such as plumber, electrician, bricklayers
- Financial institutions

- The research method for collecting of data would be qualitative analysis through questionnaires targeting the consumers, merchants and financial institutions.

- Based on the analysis of this data, a tailored payment solution would be proposed and implemented taking into consideration the research technology, such as NFC Technology and QR-code Technology discussed in the literature section that is related to payment solution, as well as taking into consideration the questions raised in the hypothesis.

- Other technology that would be used in implementing the proposed payment solution would be:
  - Front-End: JavaScript using React Native Framework or Java by using Android Development Framework for the front end of the application
  - Back-End: ASP.NET Framework (C#) or Cake PHP
  - Database: Microsoft SQL or MYSQL

- After the implementation of the prototype, testing would be conducted on Android and ISO by giving the end product to selected consumers, merchants and financial institutions.

- The prototype would be tested based on the following and bearing in mind that the end goal of this project is to see if the research proposal can reduce the amount of cash payment used during transaction:
  - Efficiency – the time taken to perform a transactions
  - The overhead cost that comes with the use of the application by the merchant and financial institution.
  - Security and Vulnerabilities that might be encountered.

- The application test process would involve the following:
  - A customer and a merchant would be required to download the application into their smart phone.
  - During registration process, the users would be ask to connect to their respective funding account or bank account.
  - The process would ask the users to open a secondary account which will be called e-

account,
  - 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.
  - Every user registered would have a registration code or identification number.
  - In the case of the merchant, this identification number would be used to generate either a QR-code or an NFC tag.
  - During a transaction, the customer either scanned the QR-code of the merchant or uses the smart phone to receive an NFC tag information of the merchant.
  - This brings up the merchant details and a box to input the amount to be paid.
  - The customer entered the amount and presses a “pay” or “submit” button.
  - Validation would be done through some processes and methods to ascertain if the customer has enough fund.
  - If there is not enough fund, the transaction would be rejected or cancelled.
  - If there is enough fund, the transaction would approved and the merchant would immediately receive a message on the merchant application.
  - Merchant receiving account information would be passed on to the customer fund managing institution for onward transfer and crediting of merchant account.

- Since the final goal of the research, which is to reduce the amount of cash payment used in transaction cannot be ascertained immediately after the testing, a brief analytical survey would be perform with questionnaire in order to know how acceptable the payment solution was received by the participants.

- This analysis would be concluded by taking a look at some of the short fall that might be encountered with the proposed mobile payment solution. These includes the following:
  - When there is no connection in a customer or a merchant or both of their smart phone.
  - When the battery of a customer or a merchant or both of their smart phone is flat.

Ethical Considerations.

Refer to *guidance points below. You are also additionally required to read MCAST Document 074 'Research Ethics Policy and Procedure' that is available on the College website via link http://www.mcast.edu.mt/MainMenu/Full-TimeCourses/Rules,PoliciesandRegulations.aspx*

1. *Research shall be conducted in such a manner so as to avoid any psychological and physical harm to humans and animals and financial damage to organizations*
2. *Only the supervisor and examiners will have access to any data gathered.*
3. *Participants will remain free to withdraw from the study at any time without having to provide any reason. In the case of withdrawal, all the records and information collection will be deleted.*
4. *The participant, who is the sole proprietor of the data provided, is granting that such data would be processed for this study purposes only.*
5. *The data collection process will be a transparent process.*
6. *All transcriptions and/or electronic recordings reflecting the data collected, once exhausted, are to be deleted*
7. *Confidentiality, anonymity and data protection procedures are to be ethically abided by.*
8. *The researcher would provide a soft copy of the study to the participant, if required.*

Enter details here regarding possibility of issues regarding confidential personal data:

How will you ensure that:

- *No personal data or confidential data is divulged.*
- *Participants' identities are not divulged (ie kept anonymous)*

Enter details here regarding possibility of physical harm:

- *How will you ensure that no person or animal gets hurt during the implementation of the research?*
- *What Personal Protective Equipment (PPE) will you be needing/using?*

Enter details here regarding possibility of moral harm:

- *What steps will you take to avoid unduly offending or disturbing the well-being of the participants?*
- *How will you avoid any possible psychological, spiritual or cultural offence to participants?*
- *How will you ensure that the interests of minors / vulnerable / disabled persons are safeguarded where necessary?*

Enter details here regarding possibility of business harm:

How will you ensure that:

- *Participants do not suffer any competitive disadvantage as an outcome of the research?*
- *Confidential business ideas and data are protected and not divulged?*

Anticipated Contributions of the Study.

If this research implementation is adopted by consumers, merchants and financial entities, it could greatly help to reduce the amount of transaction been performed by cash.

It will also create convenience for both customers and merchants in terms of not having to carry a lot cash with them at all times as well as carrying different electronic payment cards.

On the part of the retailers, merchants and financial institution, this would result to positive economies of scale where production or sales will be increased and the overhead cost greatly reduced.

Dissertation Project Plan.

This research dissertation plan will be as follows:

- Task 1: Approval of SOI.
- Task 2: Literature review.
- Task 3: Methodology: using qualitative methodology to prepare the primary survey.
- Task 4: Diagrammatic architecture and design of prototype.
- Task 5: Collection of artifacts and framework needed for the implementation.
- Task 6: Choosing software development life cycle methodology and development of prototype.
- Task 7: Selecting the users for testing of prototype and calculating the efficient of the process.
- Task 8: Evaluating the results against the hypothesis.
- Task 9: Conclusion and prototype ready for presentation.

List of Key References:

Charles A Walton (1983). Portable Radio Frequency Emitting Identifier.

Heikki Huomo, Ian Keen, Marc Borrette (2014). Communications Devices Comprising NFC Communicators.

Kevin Curran, Amanda Millar, Conor Mc Garvey (2013). Near Field Communication.

Helena Rodrigues, Rui Jose, Andre Coelho, Ana Melro, Marta Campos Ferreira, Joao Falcao e Cunha, Miguel Pimenta Monteiro and Carlos Ribeiro (2014). MobilPag: Integrated Mobile Payment, Ticketing and Couponing Solution Based on NFC

Denso Wave (1994). https://www.qrcode.com/en/

Trupti Lotlikar, …., ….(2013) Comparative study of Barcode, QR-code and RFID System

Don W. Tyler, Jeff Isenhart, Anne Mueller, Christopher Sadil (2017). QR Code-Enabled P2P Payment Systems and methods

Lauren Elmore and Derek Stephens (2012). The Application of QR Codes in UK Academic Libraries.

Caixin Weekly (Issue No. 5, 2017). The Battle of the QR Codes featured in http://www.chinatoday.com.cn/english/

Related materials:

Kelly Liyakasa (March 2012). Who Benefits from QR Codes? Featured in CRM Magazine.

Jonathan Wylie (March 2012). Scan QR Codes Easily. Featured in PC WORLD Communications Inc.

China Today. Third-party Mobile Payments Boom

Ricardo Tesoriero and Jose A. Gallud (13 August 2018). Software Architecture and Framework to Develop NFC-Based Applications.

China Today. Surging Mobile Payments in 2017.

China Today (May 2015). Mobile Payments Change Lives

Marianne Crowe, Marc Rysman, and Joanna Stavins (January 2010). Mobile Payment in the United States at Retail Point of Sale: Current Market and Future Prospect. Copyright of Research Review is the property of Federal Reserve Bank of Boston.

Fumiko Hayashi (2012). Mobile Payments: What's in It for Consumers?

This section is to be filled in by the representative of the Institute Research Sub-Committee prior to forwarding of this Form to the 'MCAST Research Ethics Committee' for final ethics approval:

Nature of ethical consideration	***Outcome (*)***	***Comments***
Consideration of possibility of issues regarding confidential personal data:		
Consideration of possibility of physical harm		
Consideration of possibility of moral harm		
Consideration of possibility of business harm		

(*) Legend to record outcome by Institute Research Sub Committee:

A *– Ethical considerations have been* ***addressed appropriately*** *by Researcher;*
B *– No (****Nil****) relevant ethical considerations are applicable under purpose of study as described by Researcher.*
C *– Ethical consideration have* ***not been addressed appropriately*** *by Researcher;*
D *– Applicable ethical consideration have* ***not been considered*** *by Researcher.*

Details of Representative to the 'Institute Research Sub-Committee.	
Name	Signature
Designation	Date