PROCESS DESIGN OF NEW DIGITAL PAYMENT PLATFORM

NAZLI ALTUNBULAK

JUNE 2022

PROCESS DESIGN OF NEW DIGITAL PAYMENT PLATFORM

A THESIS SUBMITTED TO THE

GRADUATE SCHOOL

OF

BAHÇEŞEHİR UNIVERSITY

NAZLI ALTUNBULAK

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR

THE DEGREE OF

MS in Industrial Engineering

JUNE 2022

T.C.

BAHCESEHIR UNIVERSITY

GRADUATE SCHOOL

MASTER THESIS APPROVAL FORM

Program Name:	MS in Industrial Engineering
Student's Name and Surname:	Nazlı Altunbulak
Name of The Thesis:	Process Design of New Digital Payment Platform
Thesis Defense Date:	27.06.2022

This thesis has been approved by the Graduate School which has fulfilled the necessary conditions as Master thesis.

Prof. Dr. Ahmet ÖNCÜ

Institute Director

This thesis was read by us, quality and content as a Master's thesis has been seen and accepted as sufficient.

	Title/Name	**Signature**
Thesis Advisor's	Dr. Adnan Çorum	
Member's	Prof. Dr. Hatice Camgöz Akdağ	
Member's	Doç. Dr. Sait Gül	

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last Name: …….

Signature:

ABSTRACT

PROCESS DESIGN OF NEW DIGITAL PAYMENT PLATFORM

Altunbulak, Nazlı

Master's Program in Industrial Engineering

Supervisor: Dr. Adnan Çorum

June 2022, 32 pages

This study enhances to magnify a recent digital payment platform in which is currently used by in various sectors in Turkey. With this study, an optimal way of running a platform with one product is underlined by focusing on the previous studies of platform structure and examining the current application of software technology is covered. As a sample, this unique platform in Turkey is detailed by benefits of the platform, platform experience, characteristics of the product which bring platform structure and main structure of the digital mobile payment application including integration processes, testing procedure and the cases which affect the digital payment product.

Key Words: POS, mobile phone, multi-sided platforms, Near Field Communication (NFC), contactless payment, mobile payment, payment infrastructure, payment systems

ÖZ

YENİ DİJİTAL ÖDEME PLATFORMUNUN SÜREÇ TASARIMI

Altunbulak, Nazlı

Endüstri Mühendisliği Yüksek Lisans Programı

Tez Danışmanı: Dr. Adnan Çorum

Haziran 2022, 32 sayfa

Bu çalışma, Türkiye'de ortaya çıkan ve çeşitli sektörler tarafından kullanılan yeni bir dijital ödeme platformunu ele almaktadır. Bu çalışmayla, bir platformun sürdürülebilirliği ve önceki platform yapıları göz önüne alınarak şu an Türkiye'de kullanılan ödeme uygulaması ele alınmıştır. Örnek olarak ele alınan bu platformun faydaları, platform kapsamında yaşanan deneyimler, platformda kullanılan ürünün özellikleriyle platform yapısını beraberinde getiren ana dijital mobil ödeme uygulaması entegrasyon süreçleri, test süreçleri ve mobil uygulama ürününü etkileyen konular dahilinde inceleme yapılmıştır.

Anahtar Kelimeler: POS, mobile phone, multi-sided platforms, Near Field Communication (NFC), contactless payment, mobile payment, payment infrastructure

ACKNOWLEDGEMENTS

I would like to thank my supervisor Dr. Adnan ÇORUM for his advice, highlights and support throughout the research.

I would also like to thank my parents, İsmail Öcal ALTUNBULAK and Arzu ALTUNBULAK, for their continuous support, I could have never been able to aspire for this level.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

ATM	Automated Teller Machine
NFC	Near Field Communication
PCI DSS	Payment Card Industry Data Security Standard
PTD	Personal Trust Devices
POS	Point of Sale
TAM	Technology Acceptance Model
SMS	Short Message Service
mPOS	Mobile Point of Sale
UTAUT	Unified Theory of Acceptance and Use of Technology Mode
VPN	Virtual Private Network

Chapter 1

Introduction

Increase in use of digital payment systems has been an innovative and revolutionary action between the end user and the technology provider. As nature of product, it may fail and one with better performance compared to substitutes may be better as use of the product. As testimony, even two banks as actors in a payment ecosystem supplies the same service, one bank may be clearly having a better performance than other. By looking at this approach, we can interpret that the user has in an important position as a decision-maker as being a digital product.

Considering the dynamic structure of payment arena and adaptive business models, platform structure has brought a new pace into the payment ecosystem and technology owners, such as fintech companies, shape this playground as being the newest disrupters. Bearing mind, the mobile devices widely preferred as ease in use and opportunity as instant payment has been a convincing reason for the adoption of the new digital payment product with the role sharing of merchants, banks, processors and other institutions in this invention. Those counted parties follow upcoming technologies and the finding the best fit company to implement and integrate the product. Since mobile devices as scanners, tablet devices and mobile phones have been making ground in payment sector day by day, disrupters in payment systems design creates various methods which enables the opportunity to initiate any payment with a mobile device which makes the mobile device a terminal.

Payment by its meaning, should be seen as locomotive behind the business models and the dependent characteristics are trust and security by the evolving support of payment schemes which are complement to payment method. Considering the mobile industry, mobile devices are turned into personal trust devices (PTD) which can be used to be controlled by one user and this affects multiple users on field who is willing to make payment by help of mobile device (Karnouskos et al., 2006). As literature approach, mobile payment is explained as a method to be used mobile devices to initiate

and accept payment (Karnaouskos, 2004). By this definition, there is also an indicator named as mobile device not only mobile phone. Karnaouskos (2004) identifies mobile devices may be understood as in the research as (a) tablet PC (which has a functionality to monitor any output and can be used any space of work with NFC field), (b) handheld computer (to read barcode with NFC field), (c) a smartphone and (d) an emulator (acts like a payment terminal).

As a different sample to methods above (a, b, c and d), there are also new methodologies as SmartMoney which is a third party may be considered as a formation of a saving and payment system in Uganda which widely used by cotton ginneries. SmartMoney methodology has been targeted to minimize the cost of the ownership of the financial service with the help of use of devices in daily life has a differentiated point by creating the digital currency as a wallet (Haider, 2018).

Mobile Payment has enabled the use of mobile interface to additional internet payment procedures in e-commerce sites. This differentiation has brought new characteristics as instant payment, mobility in payment, practicality in integrations processes of a payment method and monitor and track the payment flows to enhance characteristics of a digital payment product.

This study investigates the recent platform which is created with the various sectors' attendings to offer the companies a mobile payment application which enables users to do instant payment in Turkey. This study contributes to analyze the mobile application product in Turkey, observing the structure of this product in wide range end-to-end, changing needs of a payment product in time. through the synthesizing process of prior research's, the theoretical frameworks have been mentioned and distinctive samples are underlined which have similar characteristics with the recent payment method in Turkey. Through this study, role takers in this payment platform are underlined in terms of their responsibilities, operational flow and their mutual needs to set the product in minor terms and create the payment platform in major terms. In section 2 Literature Review which includes the payment system and platform definition, user-based review over payment system by underlining the users' role in a payment

ecosystem with Unified Theory of Acceptance and Use of Technology Model (UTAUT) and Technology Acceptance Model (TAM), Near Field Communication (NFC) since the dependency on the mobile payment application), platform structure. In section 3, the main research is handled with highlighting the reasons to use the digital payment product with this study and benefits of mobile payment systems in people's lives, characteristics of the digital payment product, working methodology of product with its integration details, test and production environment structure and steps to consider through this processes and post evaluation of the product after its delivery.

Chapter 2

Literature Review

Payment systems by its business and technological aspect may be understood with the cohesion of validating payment, security of sensitive information and to sustain a payment environment between merchant and user. Focusing on this research that the evolution of digital payment platform which enables instant payment opportunity to merchants in Turkey, the literature review has been covered to identify the architectural configuration of platform structure digital payment methods term considering previous research. Platform term to be mentioned through research targets the usage of one digital product used by different groups and merchants such as cargo and delivery companies, taxi companies, retail business, rental companies and any payment system which has a need of to have an instant payment. In other words, platform is considered as a web of products which serves different aims. Kazan et al. (2018) has underlined the importance of the layering mechanism of conceptuality of digital platforms as two bases as integrity of their value creation to architecture of the platform and direct or indirect effect on value creation of architecture of the platform.

Additionally, perspective of platforms is highlighted by their positive network aspects by having the engineering side to build the architecture of the platform. To explain more, platform consist of different development sides which should be planned very carefully since the operational and engineering cost may be harmful to product after platform is up and living. Harland (2020) identifies platform term as a living organism which also enlarges in time with the product development made on the payment method as product.

Capacity of product platform is captured with three points as extendibility of products, reusability of supporting systems and developing structure of supporting systems (Chai et.al, 2012). In summary study targets the success of the platform by the development processes, teams' knowledge and consistent development of the product with the increasing demand.

Moreover, the term of platform provider has been revealed by Hagiu and Wright (2015) has been focused since platform as an intermediary itself and has a characteristic of coordinate, plan and facilitate the correspondence for each participant. Kazan and Damsgaard (2014) also idealize this approach by dividing the logic of digital payment platform into three sub-titles as platform, technology and business design. “Platform design is defined as the complementary products’ and their distribution; technology design focuses hardware updates of applied technology as the pace to catch the capability of the product and business flow” (Kazan and Damsgaard, 2014).

Additional to Platform and meanings, presented payment method models are also visited in this literature review section to underline the diversity of a payment system by existence. Wenner et al. (2017) identifies the overview of 12 payment method models which are grouped into aims as which are developed for livelihood of people, educational and commercial needs. These models are listed as person-to-person, personal transactions, commercial transactions, partnered services billing, salary distribution, loan management, insurance managed savings, disaster relief and aid distribution, reimbursement, positive behavior reinforcement and donation collection. The various capability of the models above underlines the various aspect of a mobile payment system handling capacity and the integrated power of the payment system in people’s lives.

Since a payment product is based and structured on user’s needs, the mobile payment applications are also shaped and customized through the market needs in major concept and users in minor concept.

2.1 Users Based

From the user's perspective, any helpful product leaves a nice impact after experiencing a product is ready to be used afterwards. Considering the mobile payment systems as a platform, the focus point is the users since users has the power to affect popularity of the application with their actions. Liu et al. (2019) highlights the potential factors by perceived ease of use and usefulness has positive impact on the initial trust of the user which determined the decision of user to use the mobile application.

Shuiqing et al. (2012) underlines the user's intention for negatively influencing factors as social influences and personal traits as two components in their model. They identify the adoption behavior of the application as a capital point and their hypothesis are set on the social influences have tendency to minimize the perceived risk of adoption of the mobile application.

As another sample, digitalization process in India indicates that digitalization in payment ecosystem has also changes people's lives between 2014 and 2017. Considering the population, the number of mobile devices has been increased with number of users in telecom industry and provision of 4G services in global manner with demonetization policies by country administration. The Reserve Bank of India categorizes citizens to divide into five steps as unbanked, banked, active banking user, digitally enabled and digital users to report the digital inclining financial process in India (Vanithamani and Vanithamani, 2020). This categorization has enabled government to endorse citizens to transform their habits into more digital to minimize the humanitarian factors in money transfers. From this outcome, it may be referred that a mandatory switch made by government and citizens have also changed their attitudes towards payment.

Additionally, study conducted in Mexico has also been investigated as having an unbanked population with emerging economy with the decision of Central Bank of Mexico to endorse the citizens against financial inclusion. A new digital payment system has been populated named as Cobro Digital and has reached 6.4 million users in one and

half year. This product is built with the NFC technologies and enables to transfer money with QR code reading mechanism and which targets to minimize the use of banks for send and receive money transfers as a role (Developing Inclusive Digital Payment Systems, 2021).

Since payment system has a core value of trust, study conducted by Hamid and Cheng (2013) on Malaysian citizens' risk on electronic payment systems usage with payment methods differed with Technology Acceptance Model (TAM). Technology Acceptance Model centers the interaction of users with a non-experienced product before and user's process while increasing the user knowledge and experience to decrease pre-failures, which positively affects the future intention in use.

Davis (1985) explains this understanding of chain of conceptual framework of Technology Acceptance Model by three outcomes: system specialties, user's motivation to use the product and actual usage of the product as response of the acceptance. Altunbulak (2021) also identifies this ease of use in TAM has also underlined the ease of use for specific technologies and perceived usefulness as a network affect for users by the product of fungible and non-fungible tokens. This study has also a relation with this study since payment method of fungible and non-fungible tokens have been focused with the characteristics as traceable, unique, scarce, indivisible and coded which is compliment with the TAM for token users for adopting the token as a product.

2.2 Unified Theory of Acceptance and Use of Technology Model (UTAUT)

UTAUT2 (Unified Theory of Acceptance and Use of Technology2) Model is a developed model after UTAUT model by technology use in terms of organizational factor in comparison to previous model. This new model UTAUT2 is generated by Venkatesh et al. (2012) and Putranto (2020) identifies in his research the question of factors affect people to use mobile banking. This research has also common points to consider with the platform focused structure by being a digital product as well. The mobile banking services are described as transaction executions with the aid of mobile

phones. The benefit of mobile banking application to users are counted as trust of users to mobile banking applications are underlined in study conducted by Kelly and Palaniappan (quoted in Putranto, 2020) fast usage of product and continuity of the system of the mobile banking applications which minimize the need to go to a bank physically (Kelly and Palaniappan quoted in Putranto, 2019). The model UTAUT2 is set on the effect of the product on people with its real usage in Indonesia underlines the usage habits of using the mobile application and consider this product as a service and users do not consider this product as good or bad which may affect their understanding of using the mobile application (Putranto, 2020).

By speaking of payment systems, trust has been a value which binds payer and the payee while using a payment method. The usage of the product will be increasing in time with trust of the user and increasing popularity of the product. Nowadays, an initiated payment also means data exchange between two parties as customer and merchant and a new stream of financial exchanges has also let renovation of flows in e-payment which enables an easiness by payment constraints as cyber security risk (AL-Qawasmi et. al, 2021).

2.3 Payment Schemes and Operating Systems' Role in Platform Structure

Innovation literature on digital payment platforms has led differentiated mechanism of IOS and Android operating systems widely used with multiple layers composing of architectures (Kazan, 2015). Preceding works has been pointed out the only service layer as the initiation digital platforms by theoretical framework and how capable of the integrity of the platform as a product by generic meaning. Kazan (2015) has extended platform layers into five as device, system, network, service and content on mobile payment of Apple. To explain layers in brief, device layer maintains the encoded data and stored programmed processes, system layer may be understood as logical software and operational part of the platform and network is the transportation of data within the core software. Service and content layers are defined as payment as a service

and content is the shared images and information as amount, date-time, jingle of scheme and location.

Within the layers, the role of payment schemes should also be considered since their representation of branding of the payment method as an issuer identifier role. Card schemes are the responsible authorities which allows the process of the transaction between participants in a payment ecosystem. Card schemes are also responsible from the technical and marketing arrangements to service any product under their brand. The branding mechanism also protects the payment product as a reliable payment method globally by obligations (Kokola, 2010).

2.4 Importance of NFC Field in Platform Structure

Although this literature knowledge is set on the mobile application, it is also considered for a payment application and the most significant characteristic of a mobile payment application is the NFC reader of the mobile device. “NFC field on mobile devices are popularly used by the world and the components of NFC antenna consists of the following components in technical details: NFC antenna, NFC controller, secure element and host controller” (Pourghomi et. al, 2014). Their working methodology may be summarized as creating a secure cloud location where a payment application software may be executed in a secure environment, protecting the transaction data with security keys.

NFC technology by Brohi et al. (2017) admits the adoption of emerging technology by centering the intention of behavior and use of it. The intention of behavior is divided into consumer behavior and duration of experiencing the innovation, level to use the technology, degree to be influenced by other users, ease of use the technology and pleasure gathered from using the technology. Additionally, the awareness of the user to use a new technology, which is not experienced before, having a decision to adopt a new technology and risk taken by user also are used in this model.

The risk factor may also be indicated the negative events observed on other user' experiences.

2.5 NFC Technology in Platform Structure

Through the platform selection mechanism, the focus point should be maintenance of the platform and how to set in the optimal level. Eisenmann et. al (2008) defines platform as welcoming all attendees in extend of two main points as no limitation of new attendees to the platform through their integration processes and attendees are obliged to obey the entrance requirements as technical details in code implementation or paying an entrance fee. In the model of Eisenmann et al. (2008) there are four segments as end users, supplier for the platform users, platform architects and sponsors. To explain more about the players, end user is a general concept in payment application ecosystem which means the user of the product. Supplier side is the role of distributor of the built product by architect team to users and usually the branding is applied by supplier name. Architect team is the main responsible of the product which has technical knowledge to conclude the integration processes, knowledgeable element in platform and applies the technical rules for a smooth end-to-end experience for the product. Lastly, sponsor has the ownership of the platform as the general administrator and decision-maker in terms of marketing strategies for platform.

2.6 Previously Existing POS Applications

Lastly, the essential point to discuss throughout the literature review has been determined as worldwide POS technologies to indicate the changes of the application applications in last 10 years. In this section several POS, mPOS (mobile POS) technologies and concepts experienced prepares the bases of Payment Application are underlined which may be understood as the previous format of the Payment Product in

Turkey. The comparison is also identified to underline the progress of the Platform structure in Turkey.

Kim and Lim (2011) underlines the traditional POS system as the structured relation of multiple connection lines with embedded data by using multiple payment points at the same time in their study where they magnify the small retailers. The disconnectivity during the procedure is underlined as the loss of the transaction data and cancellation of the payment to be done. In the Platform and its payment application process in the conducted study, the network concept is a more complex and well design structure whereas has a similarity with the traditional POS system.

Secondly the POS system adoption by small retail companies in the Netherlands has been undercovered with the survey study by Plomp et al. The potential environment for the wide spread of the POS system is figured by the regulations and tax regulations in the year that the study is conducted as 2011. However, POS systems adoption is underlined with the 7 concepts as users' personal characteristics as gender, age, experience, innovativeness and from organizational perspective as computer literacy, size and competitiveness (Plomp et al.,2011) which a non-experienced adopter may consider to use the POS system with these differences. This sample remarks the adaptation steps of POS system in Netherland and Platform sturcture in Turkey has also common issues in terms of adaptation of the payment product usage in Turkey as the trust by users.

Any other sample application used in Taiwan mPOS (mobile POS) system named as iCHEF is a product which is used to increase the service performance of restuarants' operation flow. This structure is based on the displaying of the sales activities, tracking the number of people in the resturant, detecting the most rowded times in the restaurant and queues the people. To increase the use of this application, governemnet has enabled the filling of invoice (Lin et. al, 2015). With this study, the implication of mPOS technology is underlined with the extended service capability with the digitalization of the traditional order culture in resturants and the easiness of the application to be reached is identified as a plus.

Additionally, Poland market in the payment ecosystem is essential with the environment of multiple types of applications which enables the contactless payment acceptance. Borowski-Beszta and Jakubowska (2018) underlines the importance of the network effect which is a concept that increase the existing number of users to use the cards to initiate contactless payment with increasing benefits which minimizes the use of the traditional transactions made with chip, as a contact payment card terminals.

Lastly, considering the Akbank Cebe POS product release in the beginning of 2021 in Turkey. This project is carried out with the leadership of the Mastercard with Akbank where POS product accepts the payment with the QR code. The value proposition is defined as the low-cost ownership of the product, easy structure to accept payment and on-the go terminal support in the Mastercard Case Study (2021). This project is applied previously from the platform structure and payment application as a product of the Akbank and the documented case study found throughout the research.

Chapter 3

New Digital Platform and Its Application

In the literature review, payment system and digital payment platforms with global payment method cases considering the latest products in worldwide are discussed and magnified. In this section, the evolution of the instant payment enabling platform structure will be identified as a digital product and this section is based on experiences of the end-user and the technical software team composes of 10-12 people who is responsible from the platform lifecycle. Technical team is experienced by composition of integration processes to processors, acquirers and companies in overseas and local. Technical team composes of product manager, developer team leader with 4 developers, 2 analysts, 1 test engineer and 2 system software managers.

The digital product to be discussed through this study marketed by the most popular scheme in worldwide which will be named as scheme throughout the research. Power of scheme network has been valuable since gaining users' trust for payment action. Payment product to be discussed is a mobile payment application which enables mobile devices into POS (Point of Sale) device and helps device owners to receive instant payment. Digital payment product is also complied with the PCI DSS (Payment Card Industry Data Security Standard) and are controlled security certification processes.

PCI DSS standardization is a must for a mobile payment application which may be used to have credit and debit card transactions. This certification procedure satisfies the condition of the security of a mobile payment application to set a trustworthy bound with the new customers to be connected and already existing customers for a software company. PCI- DSS certification is a verification identity for a company which indicates the fully understanding of operation of payment card services with improving technology in years with the automated and human element factor controls. There are multiple leveled requirements that a software company should meet with the security controls to check the security leaks, encryption methodologies and application's business risk (Razikin and Widodo, 2021).

Quality of the service where the facilitation of the payment activities is handled as payment processing with the interaction between platform user and the service they receive. The service is sustained as a continuous mechanism that platform is alive and continuously working. The process for e-payment is defined with the excellence of the operation for the user as a service they receive and user's feedback on the product. AL-Qawasmi et. al (2012) groups the quality with availability and capability of the product to be used when needed, maintenance of the product when needed, responsiveness of the technical team to deliveries and ownership of the product to be used to minimize the time as cost of integration process of the product.

3.1 Reasons to Use Recent Digital Product and Benefit of Mobile Payment Systems

Considering this analysis of platform and the digital mobile payment product, Lu (2019) describes the business model reviewed by three outstanding points as value proposition, market contribution and revenue source. Three concepts are defined in order as appealing characteristics of the product, additional value on product market and gaining from the source. Considering the user as adopter of the technology to be used, user is being the decision-maker while accepting the technology to be used. According to Lu, technological advancements made on mobile payment technologies are costly lower by comparison to traditional payment methods since users may enable their mobile device into a payment point. By looking from the merchant perspective as the seller of the product, the recommendation on the payment method is also decided by them. Since the flexibility of the product is also supported by the mobile payment schemes (e.g. Mastercard, Visa, AMEX, TROY), merchant has an increasing tendency to use a product of easy to integrate, flexible usage and reduced cost considering the previously experienced payment methods.

With the evolution of the mobile payment industry, the adoption of the mobile payment application and ownership of the mobile applications as a product is increasing day by day. This allows the users to aware the benefits of the mobile application. Viz-

zarri and Vatalaro (2014) names the benefits of adoption the mobile payment applications as reduction of the fraud transactions with the developing encryption methodologies as double authentication (OTP sending procedure SMS for one time use and password verification processes). Secondly the reduction of the costs as replacement of the physical devices with the mobile devices as reducing the maintenance fee and other rental fees to be decreased. Thirdly the flexibility of the applications to be in use for a specific service. Lastly an opportunity to do a purchase in a shorter time instantly.

Mallat (2007) categorizes the mobile payments to have their relative advantage as independent from time and location by decreasing the waiting time. According to interviews made by the research, parents and young adults are focused as parents consider the value for mobile payments as owning the ticket before-hand any event whereas young adults concern the fact of the owning the mobile device already with the ticket ready for the event. The other group covered in the interviewees underline the lack of ownership of carrying the small sized coins with them and with the benefit of the vending machines and kiosks, the mobile applications are used frequently not in the need of ATM machines to withdraw money.

Tella and Abdulmumin (2015) underlines the challenges of e-payment system depending on the poor banking culture, deficiency of trust and low-level education users as reason. User satisfaction is also supported by Tella and Abdulmumin including the ease of use of the product and the perceived usefulness as user's acceptance of the system.

3.2 Platform Experience

Considering the platform product, costs until this analysis is documented which may be named as lack of time is listed as cost which outcomes from deliveries made during customization process of mobile application, operational cost, maintenance cost, cost for certification procedures, cost caused by other reasons: existence of blocker Projects as internal factors

The counted five group of cost below are observed and experienced with the platform experience. First group of cost is identified as cost which outcomes from deliveries made during customization process of mobile application. After the details of customization as logo, color code, application name and bank details are gathered from entrepreneur, the application is rebuilt uniquely and due to human factor and knowledge differences in terms of technicality the delivery process of the application may be longer than expected. This process causes a cost on mobile architecture team considering numerous applications deliveries. Second type of cost is mentioned as operational cost. This type of cost has occurred by disability to track and monitor the instant actions as unplanned outages experienced on field as systemic failures, application failures, network failures or shortage in memory of system controlled. Surely, the mobile application is continuously used 7/24 and the system failures should be tracked and alerted to technical teams. This action is essential for root cause detection of the case and entrepreneur is notified with the analysis of the case. Notification tools are currently used to track the life cycle of the platform as service controls.

Third cost is the maintenance cost may be considered also a regular cost. However, instant shortages may bring some unplanned maintenance needs in terms of time cost and financial cost to the financial institution. Additionally, there may be some needs of unplanned certification processes which shapes due to entrepreneur wants and needs, as a certification procedural cost. This creates a burden on the architect team and it may be considered as some acquirers. Lastly, cost caused by other reasons may be inferred as the prioritization of every parties' business plans. A new attendee entrepreneur may be queued due to working capacity of the technical and product teams or priority differences on entrepreneur side. The cost that block the performance of the technical teams is detailed in 5 groups and characteristics of digital payment product should also be considered.

3.3 Characteristics of Digital Payment Product

Digital payment product as seen a promising product in Turkey and a well sample to be owned by overseas. The specialties are important to consider the core value of the product considering the audience to be used of different perception to use the product and operating system variety of the devices which will shape the use of the product.

Digital Payment Product has characteristics as follows:

Easiness of plugging and playing

Minimized cost on device

Advantageous than physical payment terminals

Mobile application is able to be customized through customer's preferences such as color and logo.

Trackable reconciliated transactions

(a) Easiness of plugging and playing Payment product is fast and easy to integrate with the merchant's application. Teams of both parties of Product Architecture and Platform Member exchange their knowledge to take live the payment product. Throughout this process, the information support, documentation and test application providing has been done by Product Architecture Team. (b-c)Minimized cost on device and advantageous than physical payment terminals since the device is a mobile phone owned by courier with no maintenance fee on physical terminal: Device cost on payment sector is understood as a deadly cost on acquirer (bank) and owner of the physical POS machines. However, for the payment product, device is already owned by the user who is responsible for payment receival. Internet connection, NFC field and account activation on device will get ready the device to receive payment. (d)Mobile application is able to be customized through customer's preferences such as color and logo: Payment product is fast and easy to brand through the color of the merchant and the ownership of the product may be displayed with the color and font usage. Also bearing in mind that the payment product will be ready with the initial application where the order for the payment entered before payment receival. (e) Trackable Reconciliated Transactions Although the product of the platform is focused on turning into mobile devices into payment terminal,

the financial tracking of the transaction information has been stored in case of any reason such as audit.

The listed characteristics identifies the platform as a non-rigid and low-fractioned platform. With the aid of the technology, medium and small sized companies are enabled to use this digital payment application with a minimized cost.

Another essential part of the application is the security procedure, named as double authentication, to accessing the database through the gateway. Authorities who has access to the database are informed the importance of the protection of the financial data on the platform. Double authentication is used as a verification process as entry to the database with the VPN (Virtual Private Account) Account and SMS (Short Message Service) message sent to registered phone number of the agent.

Parties in the payment digital platform are composed of two sides as Payment Application and Platform Member. Payment Application Teams is also named as Product Architecture Team and responsible from the technical content, feature development and value-addition into the Product. Platform Member on opposing side, receiving the up-to-date features and mobile applications who is in direct relationship with the customer. Operational structure of the platform has been identified in Figure 1.

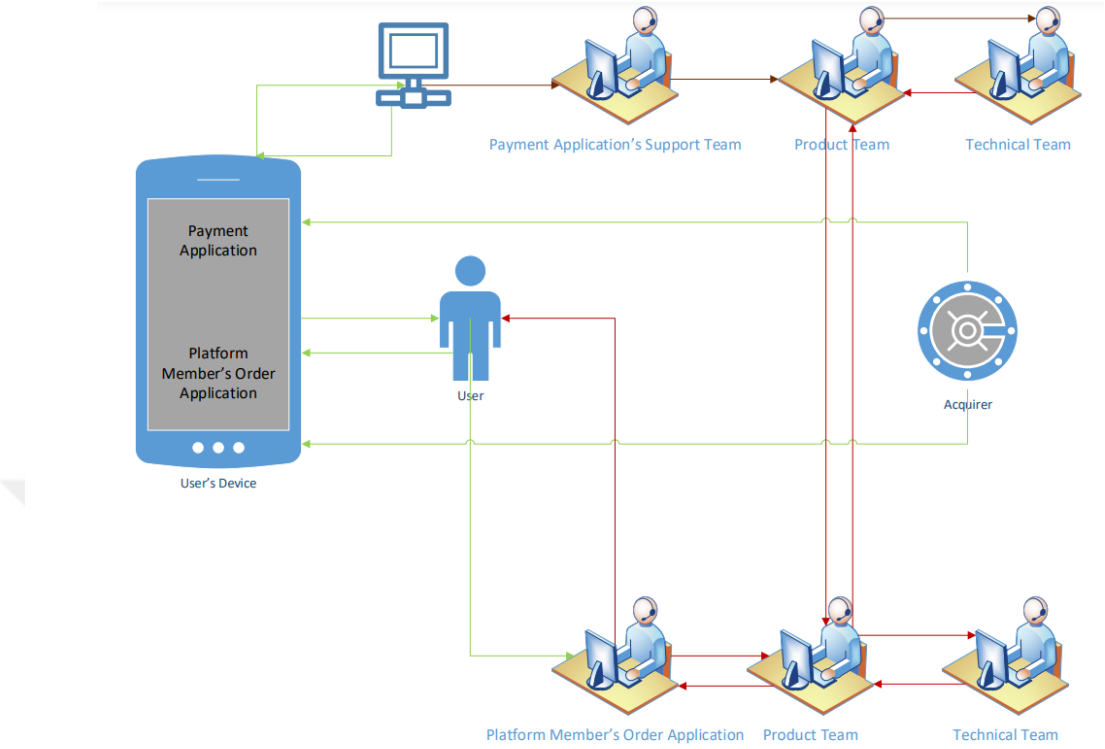

Figure 1. Operational Flow between Two Parties

In basic level, two parties handle the operational flow named as happy path, colored with green arrown that the user does not come across with any issue which user carries on to use the application and red arrow represent case where there is a defect in the flow experienced by user. The downloaded two mobile applications in one device is used by the User. Additionally, the communication between user and application is displayed as application giving a response to user and response from acquirer (bank) is also displayed on the mobile application to user. With this response displayed, user is aware of the feedback that mobile application shows and may be in need to be contact with the Platform Member's Team. Furthermore, there may be issues to be raised throughout the customer experience by the Member Team or Member Team receive from the field.

This flow is initiated by informing the Payment Application Support Team and the case is shared with the Product Team. The root cause analysis and case's solution are

getting readied with the help of the Technical team. Both Parties' Product Teams are also exchanging information regarding any issue raised.

The organizational flow of the mobile payment platform is set on the collaborative work of different parties as different functions and roles. Since the universal acceptability of the applications are shaped with the developmental supports, the corporation of different organizations are essential (Baddeley 2004). Institutions and parties are set through a plan with their rules and limits to complete the cycle in the platform that have effects in terms of minor and major roles (Briggs and Brooks, 2011). The communication procedure between parties effect the service quality in terms of responsiveness, product's usage by the user and the characteristics of the product as transparency which is an indicator of the product is not only dependent to be developed by the technical team only.

3.4 Integration of Flow of Two Separate Applications

Considering the parties that take role in platform integration, product integration steps are another dependent factor needs to be followed up. Payment Product is enabled with two mobile applications which are installed into one mobile device. These applications are named as Entrepreneur's Order Application and Payment Application. Both applications communicate and broadcast their status to track the in case of a lapse while making payment.

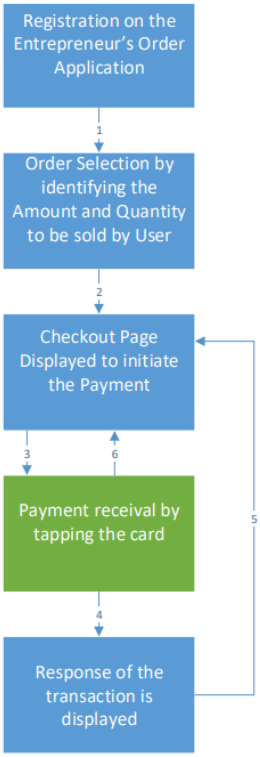

Figure 2. Working methodology of Entreprenur's (Platform Member) Order Application and Payment Application

Entrepreneur's Order Application is requested to be built by the Entrepreneur side by the order visibility and order creation steps should be built through the habits of the entrepreneurs' staff. This application should be designed to collect orders by entering amount, adding goods to card and editing the order if needed. Figure 2 represents the sequencial flow started by the Entrepreneur Order Application and payment process through the end of the flow. The Entrepreneur's Order Application triggers the Payment Application to receive the payment with the order selection and checkout page. Payment Application is opened and credit card is held near the NFC antenna of the device and

payment is received. The result of the payment is displayed for any need of repetition of the payment or successfully concluded.

3.5 Details of Integration Process Details

In the integration process, prime factors through the integration may be highlighted as user's uniqueness to monitor and track the transactions, which is achieved with the User ID value. Secondly the use of the product without any interruption in the system is another case throughout the integration process for both parties. Transaction data as user number, Amount, Currency and Date are sent from Order's Application to Payment Application which may be seen in Figure 3. Two factors are essential for tracking the financial information and keeping the information with a secure way in the application.

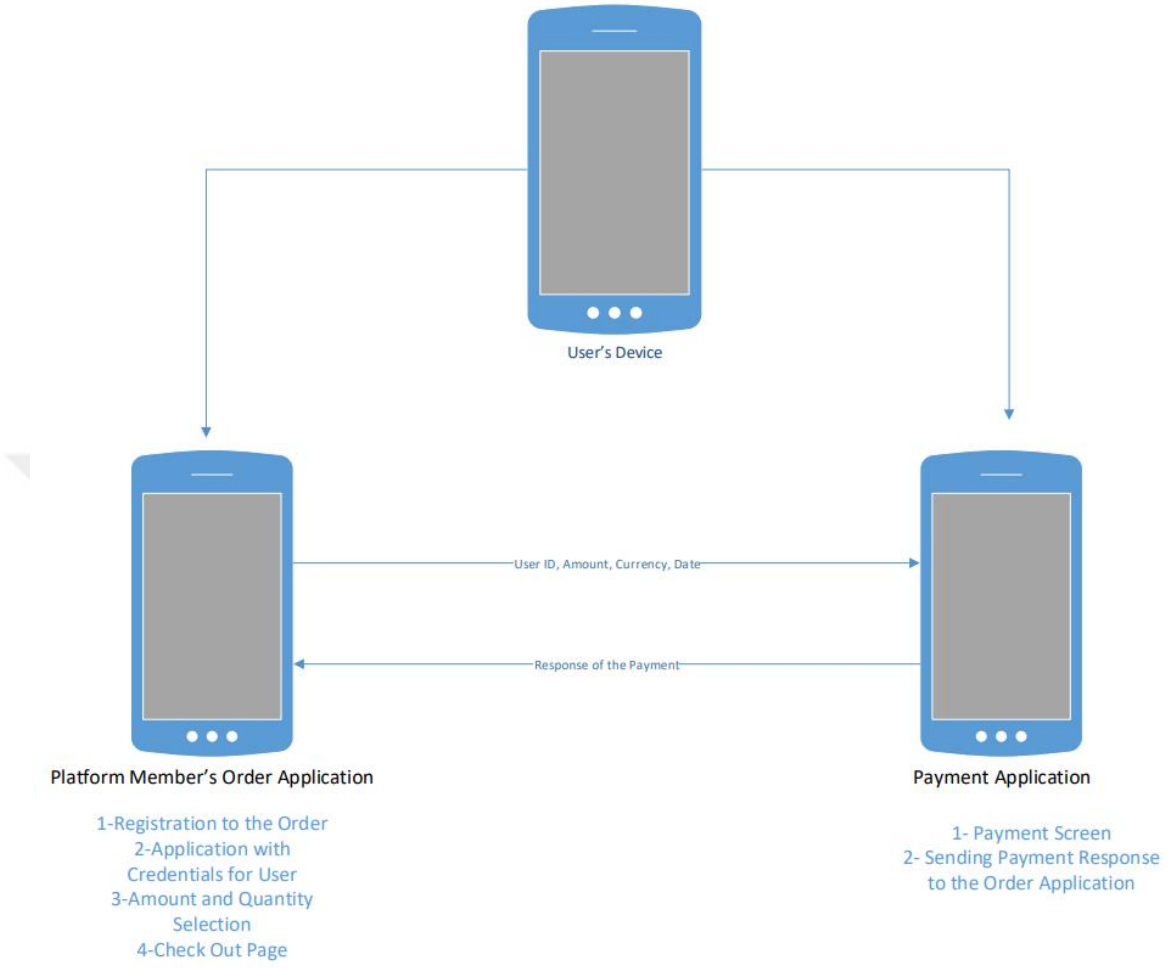

Figure 3. Two Applications Working Methodology

Entrepreneur's Order Application and Payment Application should be working smoothly and act as one application as seen in Figure 3. Even if there are two different applications, the working manner of both is serving to ability to user to have payment and they broadcast together. This methodology should be considered through the testing procedure as well.

Last but not least, it is the steps that end-to-end user experience is considered by the Platform Member and Acquirer since the transaction data and user's data are transitioned correctly through the acquiring system since the information as date, amount, user

number and other information that satisfies the condition of uniqueness of the user with correct user data. Sub-criteria should be counted as follows:

a. Users end-to-end experience of the payment application with trackable user number and conclude the transaction with a valid response.
b. Users end-to-end experience of the payment application with the acquiring information and verification of those transactions by acquirer.
c. Any customized payment application feature should be considered as another point to verify the application.
d. Trackability of the transactions within the payment flow considering the platform system as a big picture. Since platform includes numerous applications, the traceability of the transactions considering the frequency of the transaction made in seconds and data load of each application.

3.6 Test and Real Time Applications

Two flows mentioned above identifies the application building steps for test and production environments. The details with green are on Payment Applications Team and blue boxes are delivered by the Platform Member and Entrepreneur Team. From the steps below, for two diagrams, the workload is shared and there are requisites that affect the quality and service aspect of the platform.

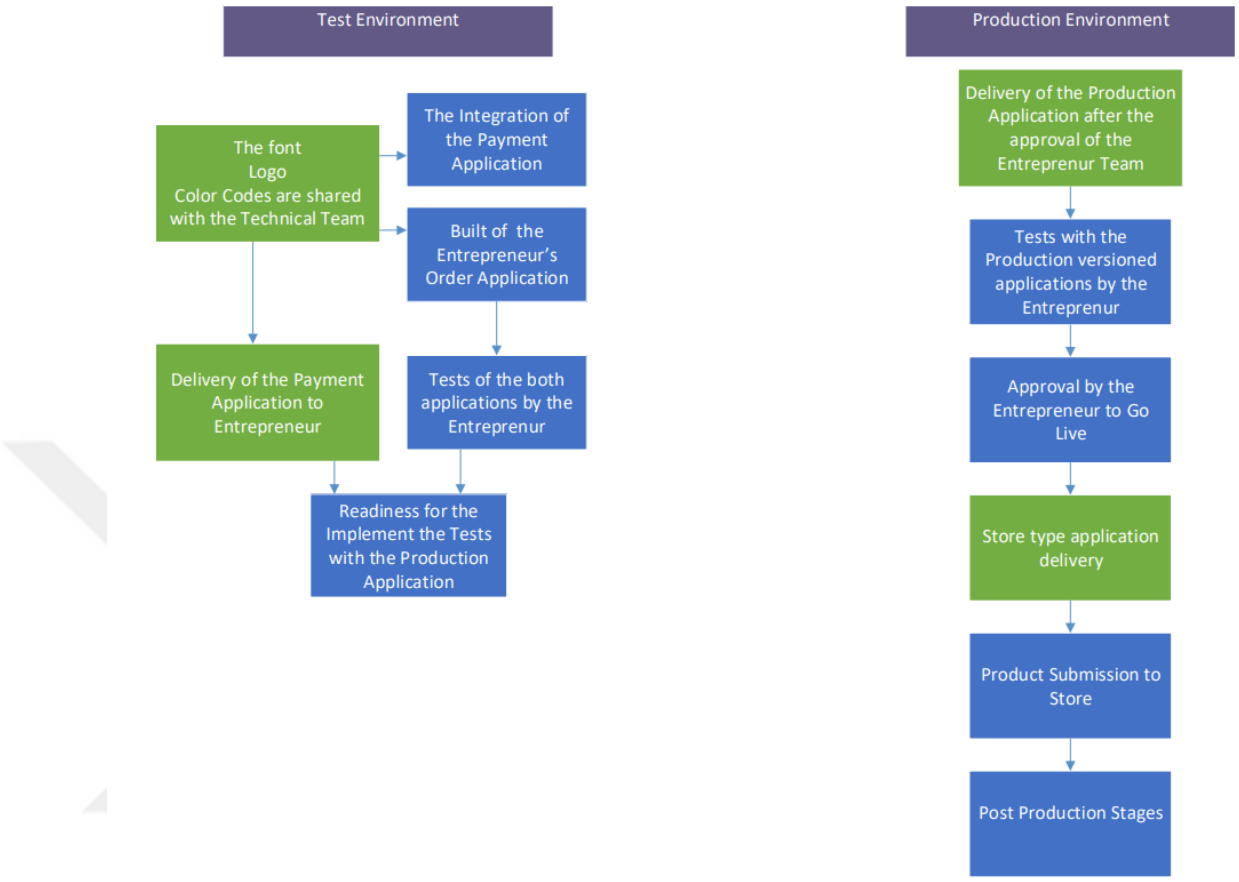

Figure 4. Test and Production Application Building Steps

From the Figure 4, the check points are inferred as testing the test application and approval process of the production application as the third step of the production. Also, the variety of the devices which are payment application is executed is a significant point to consider during the testing process which outlines testing process. Usman and Khawaja (2019) underlines compatibility testing methodology has been used to underline the numerous devices with differentiated operating systems. Compatibility testing for mobile applications is highlighted with two cases as high number of mobile devices to be executed on different platforms and cost of compatibility testing of different architectures of mobile applications. Tests handled throughout the platform are handled in

formats of automated tests and manual tests by including human factor. There are also additional formats used as including a test server which works with the process management, scheduler, monitoring and reporting. This system may help tester and the technical team to be aware of the defects and bugs to block the previous may raise by the opposing team or client. With daily checks, by the help of automated tests and daily notification, bug-free mobile payment application is continuously getting tested (Zhang et. al, 2015). Those two formats are used in the mobile payment applications within the platform. Since the terminal information is unique to every platform application, test outputs are reviewed and taken as a task by the Product Team.

Considering the fact of testing a mobile application has been significantly increasing concept with the changing world's digitalization habits and increasing number of conscious application users in daily life. With this purpose, the mobile payment applications have been also underlined the importance of the testing stages of a payment application. There are types of tests executed by quality and testing engineers as automated testing scenarios and manual tests which considers the end-to-end tests which are designed along with the mobile application product (Usman and Khawaja, 2019). To minimize the risk of fraud, to detect an issue on production fast and to test a new feature or to fix a defect found, tests are settled in the process of the most important part of the mobile applications. The most essential part of the developing an application is mentioned as efficient mobile testing before the delivery of the product in terms of quality targeted for an application.

In production stages, which is on the righ-hand-side of the Figure 4, the branding and increase in popularity of the application has been a concerning issue by platform member. After the demo application which the tests are executed, the real-time tests are also checked as a last step before live stage. The real time case with the real time acquiring information is controlled by the Technical team. The working methodology and the flow of the user experience through tests should be the liquid and financial risk is minimized in the applications with multiple type of test devices with operating systems.

After the real-time application is submitted on Store, it is downloadable by users and the payment application is up and living. The controlled popularity of the user enables to track the any production cases which are not experienced in the test and production testing procedures. When a new platform application is used, the number of cases as defects in production may be tremendous and various in terms of type of any error. The widespread use of payment application changes up to the bullets as: (a) device name as operating system, (b) education level of the user, (c) telecommunication brand, (d) usage of cracked devices by users. (a) device name as operating system is item which underlines the different and updating operating systems usages by people and increasing versions day by day. (b) education level of users as clerks are essential point to identify because due to any negative experience, clerks have tendency to leave the mobile application usage and this may cause a decrease in mobile payment applications. (c) telecommunication brand is another case to consider because any problem in the telecommunication network may cause the platform and intervention on the platform may not be applied due to no reach to the users. (d) usage of cracked devices by users is the last bullet to underline which minimizes the use of the mobile payment application. Since the product is a payment application, it has security controls to catch any issues which is on device and this controls do not let the mobile application to be used by its nature. Clerks in platform who use their own mobile devices struggles with this case. These counted items are grouped as the identified reasons which minimizes the use of the mobile payment application and the detected errors are fixed with the aid of the technical team by weekly grouping methods.

3.7 Post-Evaluation After Delivered Mobile Payment Application

As payment product, there are also other alternatives in the market. However, the product as including the platform has an outstanding difference from the other products with the support of the scheme and the knowledge of the technical team with the structure of being a platform in Turkey. The continuity of the payment application is depending on the decision of the platform member switching the service with another rival. In this process, the consistence of the applications is used and positive feedbacks from the

field are the important gatherings to give the leaving decision of the platform. Also, the new platform member should understand the products' development with new features added to the mobile payment application.

"Platform, as a concept, is defined as a gathering of group of people which centralizes innovative actions by a specific group of people" (Marjchrzak and Malhotra, 2017). elaborate on two reasons of importance of the term of online crowd named by them. Researchers underline the importance of information sharing and popularity increasing of using a product. Additionally, Cronin and Weingart (2007) underlines the variety of representing single case with different interpretation by multiple teams. Platform concept has been related with the knowledge sharing logic which enables platform attendees to create new features to the product considering different platform needs (Cronin and Weingart 2007). In the previous research of Sahi et. al (2021) the continuance decision is sustained with the increasing competitive advantage and minimized risk to survive of the application. In Platform Payment Application, the platform attendees are risk takers who are aware of the new structure and bringing's of a developing platform.

The framework for Mobile Payments is identified by Venkatraman (2018) as the composition of three ingredients as business, social and technology ingredients. These ingredients as a strategy targets the technological aspect with the evaluation of solutions in the market and their limits to implement a change. Secondly the business perspective is based on the characters within the market. Lastly, the social aspect is observed by the crowd sourcing and observing the feedbacks to derive a marketing strategy from the usage of mobile payment application.

Chapter 4

Conclusions

The payment method recently used in Turkey is promising to spread overseas in developing and developed economies which enables a payment platform ecosystem as well. Since the cashless ecosystem adoption are endorsed by the government and institutions considering the samples mentioned in this study, the platform structure is foreseen to be settled in time with the increasing trust of clerks and users, number of transactions in platform and number of entrepreneurs in platform will be increasing. The study investigated may be enlarged with identification of different sectors since their aim of using the mobile payment product may be different. The approach to the mobile payment application may be compared with after the features are integrated by technical team as a comparison.

REFERENCES

Ab hamid, N. Aw, Y. C. (2013). A risk perception analysis on the use of electronic payment systems by young adult. *WSEAS Transactions on Information Science and Applications*. 10. 26-35.

AL-Qawasmi, K. Almousa, M. & Yousef, M. (2021). Proposed E-payment Process Model to Enhance Quality of Service through Maintaining the Trust of Availability. 2296

Altunbulak N. (2021). A Conceptual Evaluation on Token as A New Candidate Payment System. *ETMS 2021 Proceedings* – International Engineering and Technology Management Summit Retrieved from: https://etms.itu.edu.tr/2021/wpcontent/uploads/2021/12/ETMS2021_Proceedings_Book-1.pdf -->12

Baddeley, M. (2004). Using e-cash in the New Economy: An economic analysis of micro payments systems. Retrieved from: https://www.researchgate.net/publication/249852555_Using_E-cash_in_the_New_Economy_An_Economic_Analysis_of_Micropayment_System

Bandura R.,Ramanujam S.R., (September 2021). Developing Inclusive Digital Payment Systems, Center For Strategic and International Studies. Retrieved from https://www.csis.org/analysis/developing-inclusive-digital-payment-systems bandura 1-12

Borowski-Beszta, M.& Jakubowska, M. (2019). Mobile payments using NFC technology in the light of empirical research. 17. 5-16. 10.19197/tbr.v17i3.311.

Briggs, A. Brooks, Laurence. (2011). Electronic Payment Systems Development in a Developing Country: The Role of Institutional Arrangements. *The Electronic Journal of Information Systems in Developing Countries*. 49. 10.1002/j.1681-4835.2011.tb00347.x.

Chai, K.-H., Wang, Q., Song, M., Halman, J. I. M., Brombacher, A. C. (2012). Understanding Competencies in Platform-Based Product Development: Antecedents and Outcomes. *Journal of Product Innovation*, 29(3), 452–472. Retrieved from https://proxy.bau.edu.tr:2102/10.1111/j.1540-5885.2012.00917.x

Cronin, Matthew & Weingart, Laurie & Tepper, David. (2007). Representational Gaps, Information Processing, and Conflict in Functionally Diverse Teams. *Academy of Management Review*. 32. 761-773. 10.5465/AMR.2007.25275511.

Davis, F. (1985). A Technology Acceptance Model for Empirically Testing New End-User Information Systems.

Eisenmann, T. Parker, G., V. A., Marshall. (2008). Opening Platforms: How, When and Why?. *Platforms, Markets and Innovation*. 10.2139/ssrn.1264012.

Hagiu, A., Wright, J. (2015). Multi-Sided Platforms. *International Journal of Industrial Organization*, Vol. 43, 2015, Retrieved from http://dx.doi.org/10.2139/ssrn.2794582

Haider, H. (2018). Innovative Financial Technologies to Support Livelihoods and Economic Outcomes, K4D Helpdesk Report. Brighton, UK: Institute of Development Studies. Retrieved from https://gsdrc.org/wp-content/uploads/2018/07/Digital_financial_services.pdf

Harland, P., Uddin, A., Laudien S. (2020). Product Platforms as a Lever of Competitive Advantage on a Company-wide Level: A Resource Management Perspective. *Review of Managerial Science*. 14. 10.1007/s11846-018-0289-9.

I. A. Brohi, Ali N. I,Karbasi M. Shah A., Akbar A., Gharamah A. R.Ali A.(2017). Near field communication enabled payment system adoption: A proposed framework, *2017 IEEE 3rd International Conference on Engineering Technologies and Social Science*s (ICETSS), 2017, pp. 1-5, doi: 10.1109/ICETSS.2017.8324199.

Karnouskos, S. (2004). Mobile payment: A journey through existing procedures and standardization initiatives. *IEEE Communications Surveys & Tutorials, 6*. Retrieved from https://ieeexplore.ieee.org/document/5342298

Karnouskos, S., Vilmos, A. (2006). Universal Approach to Mobile Payments. Retrevieved from 10.4018/978-1-60566-054-7.ch182**.**

Kazan, E., Damsgaard, J. (2014). An Investigation Of Digital Payment Platform Designs: A Comparative Study Of Four European Solutions. *ECIS 2014 Proceedings* - 22nd European Conference on Information Systems.

Kazan, E., Tan, C., Lim, E., Sørensen C., Damsgaard, J. (2018). Disentangling Digital Platform Competition: The Case of UK Mobile Payment Platforms. *Journal of Management Information Systems*. 35. 180-219. 10.1080/07421222.2018.1440772.

Kazan, Erol. (2015). The Innovative Capabilities Of Digital Payment Platforms: A Comparative Study Of Apple Pay & Google Wallet.

Kelly, A.E., & Palaniappan, S. (2019). Survey on Customer Satisfaction, Adoption, Perception, Behaviour, and Security on Mobile Banking. *Journal of Information Technology & Software Engineering, 9*, 1-15.

Kim, Y. & Lim, J. (2011). A POS system based on the remote client-server model in the small business environment. *Management Research Review*. 34. 1334-1350. 10.1108/01409171111186432.

Kokola T.,(2010).Payments, Securities and Derivatives, and the Role of Eurosystem Retrieved from : (https://www.ecb.europa.eu/pub/pdf/other/paymentsystem201009en.pdf)

Lin, Y. C. & Ha, N. & Lin, K. (2015). The Role of mPOS System in Process Change and Strategy Change: A Situated Change Perspective. *Technologies*. 3. 198-218. 10.3390/technologies3040198.

Liu, Z., Ben, S. & Zhang, R. (2019). Factors affecting consumers' mobile payment behavior: a meta-analysis. *Electron Commer Res 19*, 575–601. https://doi.org/10.1007/s10660-019-09349-4

Lu, L. (2019). Mobile Payments—Why They Are So Successful?. *Open Journal of Business and Management*, 07(03), 1131–1143. https://doi.org/10.4236/ojbm.2019.73078

Majchrzak, A., Malhotra, A. (2017). Effect of Knowledge-Sharing Trajectories on Innovative Outcomes in Temporary Online Crowds. *Information Systems Research*. 27. 10.1287/isre.2016.0669.

Mallat, N. (2007). Exploring Consumer Adoption of Mobile Payments—A Qualitative Study. *The Journal of Strategic Information Systems*. 16. 413-432. 10.1016/j.jsis.2007.08.001.

Plomp, M. & Huiden, R. & Batenburg, R. (2011). Determinants of Point-of-Sale System Adoption: A Survey among Small Retailers in The Netherlands. *17th Americas Conference on Information Systems 2011*, AMCIS 2011. 3.

Pourghomi, P. Saeed, M., Ghinea, G. (2014). The Need for Integration in NFC Mobile Payments. *Journal of Information Assurance and Security*. 9.

Putranto, A. (2020). Acceptance Technology Factors of Mobile Banking Usage Based on UTAUT2 Model. *Jurnal Riset Akuntansi Dan Bisnis Airlangga*. 5. 10.31093/jraba.v5i2.234.

Razikin, K., & Widodo, A. (2021). General Cybersecurity Maturity Assessment Model: Best Practice to Achieve Payment Card Industry-Data Security Standard (PCI-DSS) Compliance. *CommIT (Communication and Information Technology) Journal*.

Sahi, Alaa & Khalid, Haliyana & Abbas, Alhamzah & Khatib, Saleh. (2021). The Evolving Research of Customer Adoption of Digital Payment: Learning from Content and Statistical Analysis of the Literature. *Journal of Open Innovation Technology Market and Complexity*. 7. 10.3390/joitmc7040230.

Shuiqing Y. Yaobin L., Sumeet G., Yuzhi C., Rui Z. (2012). Mobile payment services adoption across time: An empirical study of the effects of behavioral beliefs, social influences, and personal traits, *Computers in Human Behavior, Volume 28, Issue 1*, Pages 129-142,ISSN 0747-5632, https://doi.org/10.1016/j.chb.2011.08.019.

Sriram, M. Vanithamani, M., M. R, Vanithamani. (2020). A Study on the usage of E-Payment System and its Influence to Digital Financial Inclusion in Coimbatore District, Tamil Nadu. *Test Engineering and Management*. 83. 2057 - 2066.

T. Zhang, J. Gao, J. Cheng, T. Uehara, Compatibility Testing Service for Mobile Applications. (2015). IEEE Symposium on Service-Oriented System Engineering, pp. 179-186, doi: 10.1109/SOSE.2015.35.

Tella,A. & Abdulmumin,I. (2015).Predictors of Users' Satisfaction with E-payment System: a Case Study of Staff at the University of Ilorin, Nigeria. Organizacija,48(4) 272-286. Retrieved form : https://doi.org/10.1515/orga-2015-0018

Turkey Mastercard Case Study. (2021). Tap on Phone. Retrieved from : (https://www.mastercard.com/content/dam/public/mastercardcom/na/global-site/documents/turkey-case-study.pdf)

Usman A. & Khawaja A. (2019). Mobile Application Testing Tools and their Challenges: A Comparative Study. 10.1109/ICOMET.2019.8673505.

Venkatesh, V., Thong, J. Y. L., Xu, X. (2012). Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of

Technology. *MIS Quarterly*, *36*(1), 157–178. Retreieved from: https://doi.org/10.2307/41410412

Venkatraman, S. (2018). Strategic Framework for Mobile Payments. *International Journal of Managing Information Technology*.

Vizzarri, A., Vatalaro, F. (2014). M-Payment systems: Technologies and business models. 1-6. 10.1109/EMTC.2014.6996626.

Wenner, G. Bram, J. Marino, M. Obeysekare, E. Mehta, K. (2017). Organizational models of mobile payment systems in low-resource environments. *Information Technology for Development*. 24. 1-25. 10.1080/02681102.2017.1311830.