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AN EMPIRICAL ANALYSIS OF THE INTERNATIONAL MOBILE PAYMENT STARTUPS

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Abstract

This study is about an empirical analysis of the services and anticipated trends of international mobile payment startups. Mobile payments include payments that have been carried out through digital mobility technologies, by cell phones, and with or without the use of mobile telecommunications networks. These kinds of payments are digital financial transactions, nonetheless, they may not be connected to financial institutions or banks.

This study can be divided into two main parts: first part deals with the original work conducted by the researcher and writer of the thesis which is presented in the two chapters. Chapter 3 presents the methodology of the census, the data gathering methods which mostly obtained from CrunchBase database, specific boundaries of the analysis, and detailed process of category definitions.

Chapter 4, entitled "International Startup Trends" presents an extensive analysis over the data acquired by the census including the different kind of figures about startups, discussion of the results, derivation of the trends over the time, analysis of the results and different comparisons. At the last part of this chapter, a special focus on Italy has been presented.

The second part of the work mostly derived from the literature, regarding mobile payment includes chapters 1, 2, and 5. In chapter 1, an introduction and a brief historical overview along with a conceptual background are presented. Chapter 2 comprises a very specialized and comprehensive literature review on mobile payment. In the six different sections, it covers the most important issues of the topic including mobile payment strategy and ecosystem, technology and technological environment, customer adoption, business models and revenue streams, three case studies in the field, and finally a brief startup ecosystem overview. Chapter 5 deals with the evolution of mobile payment including future challenges and opportunities and possible scenarios for this industry. Ultimately, the last chapter states the conclusion of the whole research.

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Executive Summary

Because of the increasing popularity of alternative payments solutions and digital commerce, a drastic shift in digital payments trend is anticipated. Global digital commerce volume (defined as all consumer remote POS transactions via online or mobile channels) surpassed by $3 trillion in 2017 and will be expected to become more than double by 2022 (McKinsey&Company, 2018). The new digital payments in Italy arrived at €80 billion which shows more than 50 percent growth respect to 2017. The forecasts reveal that it is predicted to surpass €125 million by 2021. (Oss.M-Payment, 2019).

In this Study, a census of the international startups in mobile payments is done. Besides, a data analysis and results classification are done to give a clear idea about the present and future trends. By introducing the concept and topic background, it presents an extensive literature review on most important aspects of the topic. The opportunities, challenges, and future possible scenarios are described. It concludes by the discussion of core findings, shortcomings, and recommendations.

Concept and Background

Fixed line billing, charge mobile lines, and mobile billing systems had several issues and constraints including high payment transaction fees, complaints about unfair revenue sharing between the service provider and merchants, and the necessity of the allocation of services to the billing system (M. Peirce, 1999) (H. Tewari, 2003). There is a relatively huge misunderstanding of the term of mobile payments. Therefore, in this survey the definition is presented.

Mobile payments: Mobile payments include payments that have been executed through digital mobility technologies, by cell phones, and with or without the use of mobile telecommunications networks. These kinds of payments are digital financial transactions, nonetheless, they may not be connected to financial institutions or banks (Laukkanen, 2008).

M-payment Ecosystem & Strategy, Technology, Adoption

Based on some economic and strategic aspects, a framework was suggested to recognize relevant stakeholders in the mobile payment ecosystem, that is, consumers, merchants, technology producers, and regulators (Y.A. Au, 2008). Notwithstanding major efforts to design a satisfying business model to enhance this key collaboration has been done, the difficulties for these inter-dependent firms to form partnership prevented the emergence of successful mobile payment platforms. The analysis of a resource-based view on banks resulted in the identification of strategic assets, owing to which it can be discussed that the banks still have a key role to play in the mobile payment ecosystem (A. Gaur, 2012).

To analyze the strategies of market actors another framework has been proposed by Kazan, which investigated three cases through the perspectibe of multi-sided platform theory. According to their study, the key factors for a payment platform to be feasible include network effects, bundling, and switching costs (Kazan, 2013). The emergence of the new important market actors like Google, PayPal, Apple, and Alibaba in the mobile payment market, intrigued the new researches to examine how they will affect the technology ecosystem. Particularly, they investigated mobile payment solutions from third parties (Ondrus J. L., 2011).

The major concern with digital payment is the level of security in every step of the transaction. If there is even the slightest possibility that the payment system may not be secure, trust and confidence in this system will begin to weaken, resulting in destroying of the infrastructure of the electronic commerce (H.-C. Yu, 2002). Besides payment transaction handling, it is crucial to consider how to prevent fraud, to achieve secure acknowledgment, processing of unconfirmed, invalidated, and restrained transactions with a transaction rollback (Dahlberg, 2015).

According to the literature review, adoption factors are topped by *perceived ease of use* and *perceived usefulness*; followed by the *trust* and the *risk*. the *security* is also one of the most important factors ranked 6th right after the *demographic* factor.

Mobile Payment Systems

Mobile payment system (MPS) can be defined as any payment system that authorizes financial transactions to be conducted securely using a mobile device, from one organization or individual to another over a mobile network. (T. Halonen, 2002). MPSs can be classified in different ways from which one of the internationally accepted ways is as follows: ***a remote payment***, where the user

makes a payment using a mobile device to access the m-payment back-end system via mobile communication networks, or ***a proximity payment***, where the user makes a payment using a mobile device and short-range communication technologies (P. Wang, 2012). It can also consider a broader m-payment categorization based on a wider range of criteria including payment basis; payment medium; payment timing; payment amount; and payment location.

Business Models

The most popular business models in the literature are as follows.

Operator-centric business model, in which the mobile operator puts the mobile payment application on its customers' NFC mobile devices. Operator either supplies a wireless POS to the merchant or activates the proximity payment application on the merchant's NFC mobile device (Alliance, 2008).

Bank-centric business model, in which mobile network operators are not engaged in the payment process. Banks are handling payments management through their mobile application. Mobile carriers can only leverage on the SIM-based technologies and thus, get paid by the banks a fee for the mobile network services (F. Asghari et al, 2010).

Peer-to-peer business model is an innovative model created by the new players in the payment industry to identify new processing paths without using existing wire transfer and bank card processing networks. It is less costly and handles Internet bill payments in real-time (Alliance, 2008).

Collaboration business model entails cooperation among banks, mobile operators and other stakeholders in the value chain, including a trusted third party to manage the utilization of mobile applications. In this model either a mobile operator collaborates with one bank to provide a bank-specific mobile payments service, or representatives of mobile operators and financial institutions negotiate to define standards for applications that permit multiple card types from different banks to be employed (Alliance, 2008).

Startup Ecosystem

Definition of an entrepreneurial ecosystem, based on a synthesis of definitions found in the literature, can be expressed as follows: *"a set of interconnected entrepreneurial actors, entrepreneurial organisations, institutions and entrepreneurial processes which formally and informally coalesce to connect, mediate and govern the performance within the local entrepreneurial*

environment" (C. Mason, 2014). Six most influential domains of entrepreneurship to be self-sustaining are favorable policy, markets, capital, human skills, culture, and supports (Isenberg, 2011).

Methodology

The primary source of the information is the Crunchbase website that is a platform for finding business information about private and public companies. It should be noted that the information on this database is added by the startup owners themselves rather than by investors. Therefore, it is always recommended to integrate what is collected from Crunchbase with other sources. For defining the boundaries of the research, the "Crunchbase Pro" features are utilized to narrow down the results.

Founding date limit was set to the last day of the year 2013 that is 12-31-2013 which includes all the startups that are founded in the last 5 years.

Operating status has been set to "Active". That is, the startup is alive and is not closed, neither has done an exit nor acquired.

Last funding date was set to the last day of the year 2016 that is 12-31-2016 which includes all the startups that were funded at least once in the last two years.

Continent are considered as Asia, Africa, North America (e.g. Mexico), South America, Europe (e.g. Russia), Oceania, and Middle East (e.g. Turkey & Israel).

Application areas are defined as follows.

1. ***Mobile Commerce***: This category basically includes the e-commerce transactions which are done through handheld devices like Cell phones or Tablets.
2. ***Mobile Wallet***: Includes the applications which provide the payments, or the realization of the services associated with the purchase process such as Mobile Loyalty or Mobile Couponing. These services enable the merchants to extend their channels towards business development.
3. ***Bitcoin***: Includes all the services based on the blockchain technology that uses cryptocurrencies instead of real money to do mobile transactions online.
4. ***Payment Acceptance***: Providing the ability to pay in the mobility and having accessed to real-time data and credentials of the customer, these services realize the process of making the customer close to the cash desk, by means of revolutionizing the payment experience in the store.

5. ***Technological Solutions***: provides the infrastructure of the mobile payments such as Mobile point of sales or mPOS, application program interfaces or APIs, augmented and virtual reality AR/VR, online platforms, and payment gateways.
6. ***P2P (peer to peer):*** The base of these services is the money transfer between persons; However, some innovative applications called as P2B that enable the persons to pay to businesses. These services are also used by big OTTs of the social media like Facebook.
7. ***Others:*** The specific startups whose primary functions will not fall into any of the above mentioned standard pre-defined categories such as those that utilize the biometric characteristics of the users as a payment mean.

Census Results

Mobile wallet category is pioneering in the field by 103 startups, followed by the mobile commerce by 86 startups. It shows the importance of the mobile wallet in 2018. These two categories together comprise more than 50% of the startups. More than $3.8 billion of the funding is done over the mobile commerce. The second place belongs to mobile wallet that could get almost $1.4 billion. These two categories together received almost 80% of the whole funds. Business to customer (B2C) approach as the leader strategy in the market, has attracted 80% of the total funds.

North America continent is the absolute leader in the number of startups by hosting over 130 startups. Followed by Europe with 90 startups. Unlike the leading number of startups in North America and Europe, the most funding has received in Asia which is sustaining more than 50% of the total funds in the world.

The source of the peculiarity of funding in Asia can be easily identified by going deeper through data of the Asian continent. China alone has funded almost $3 Billion only four Chinese startups. Followed by India, South Korea, and Hong Kong with more than a $100 Million investment.

Trends Analysis

The indicators prove decreasing trend in both the number of startups and the average total fund during the past five years. To define a summit for this trend, the past data are used to compare with new data and make the trend more comprehensive. It could be inferred that 2014 can be called the *golden funding year* of the startups as it has the peak in the average total fund and number of startups. After 2014, funds volume and startups numbers have been decreased year by year,

till 2018 which is so low (only $3 million) comparing to the previous years that is not even visible in the chart (see figure 1).

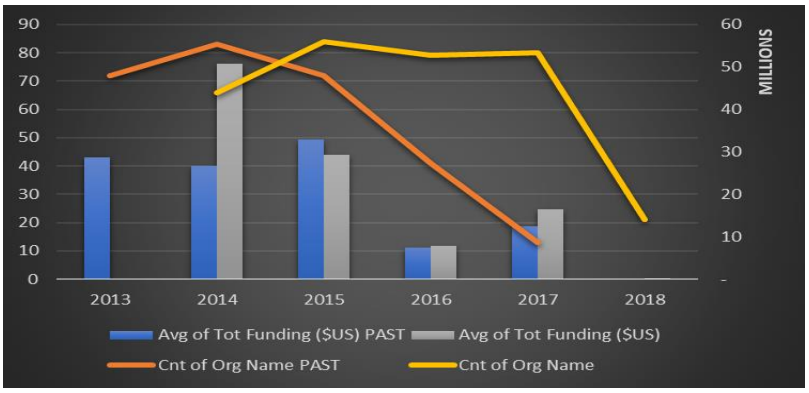

Figure 1 Trends of Average total fund and startup count by year

A part of this may come back to the not announcing the funding on the Crunchbase site and waiting for the end of 2018 to announce the final fund; However, it cannot take the whole responsibility for such a huge decrease.

Another trend is the total startup count and average total fund of 2018 and 2017 respect to categories. all the numbers in 2018 are increasing respect to 2017 except mobile wallet; However, the mobile wallet received the highest amount of fund among all categories (see figure 2).

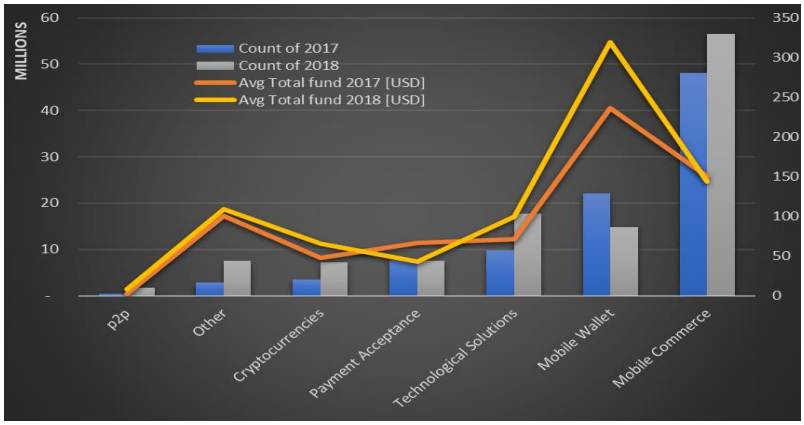

Figure 2 Trends of startup count and Average total fund by primary tag

Comparison of the startup numbers of 2018 and 2017 shows that top three countries are the same by the leadership of the United States, by increasing from 105 to 120 startups. Another interesting point is the emergence of Singapore in the top ten by 8 startups which shows a huge investment by the country in the field.

Comparison of the startup funds of 2018 and 2017 shows China and United States are the top two. United Kingdom in the third place and India in the fourth one, were experiencing a magnificent jump over all other countries. This could not be achieved

without having invested close to half a billion dollars, and roughly 400% increase respect to 2017 amount.

Italy could reserve its position in the startup numbers at the 13th place. Regarding the total fund there is no exact info; However, it is considered roughly $35 million. Therefore, Italy will jump up to 17th right after Canada and upper than Switzerland.

Secondary Tag Analysis: Secondary tags are defined to classify the service sectors. In cryptocurrency category, most of the startups are providing a Wallet service. In m-commerce, the 1st popular service is Booking. The 2nd popular service in m-commerce category is Marketplace, which is basically a kind of online shopping and can be provided in various fields. The m-wallets are primarily designed for Payment. The 2nd popular service in m-wallets is Promotion and Loyalty program. Most of the time mobile wallets embed more than one of these services in their mobile application. An interesting point is the high number of credit cards tag in the mobile wallet category, specifically 15 startups. That includes the mobile wallets which issue also a credit card or debit card, that can be monitored, controlled, accessed or blocked via the wallet they are associated to.

Innovative startups emerged in the payment using the biometric characteristics of the user called Bio-ID. Not surprisingly, the Payments category by having 79 startups, is the pioneering Secondary tag. The next hot topics include Loyalty programs by 37 startups, Booking by 31, and Marketplace with 26 startups

Evolution

Existing m-payment systems must continuously be adapted by designers to permit customers to leverage on the associated benefits while guaranteeing secure and robust payment transactions. Several challenges and opportunities are as follows.

5G: The next generation network technology empowers the users to transfer gigantic data files including high-quality digital movies almost without limitation. It permits customers to enjoy a wide range of services like 3D movies and games, real-time streaming of ultra-high-definition content, and remote medical services.

Cloud: A cloud-based m-payment system is a kind of proximity payment that keeps payment credentials on a remote server rather than at the mobile device which will be further employed to validate the payment transaction (M. Crowe, 2012). Notwithstanding the advantages provided by cloud-based m-payment systems, some security issues are still decoded. For instance, if the cloud server is attacked, stored payment credentials and payment data in the cloud could be compromised.

Restricted Connectivity: a restricted connectivity scenario will be defined as one in which two units of a mobile payment system cannot communicate with each other directly and must do it via a third party. Notwithstanding the new obstacles brought by the RCS, mobile payment systems designers should guarantee the same security levels as those based on the full connectivity scenario (J.T. Isaac, 2012).

Encryption Technology: A possible substitute approach to public-key cryptography is Elliptic curve cryptography (ECC). Based on the elliptic curve logarithm, the required key size to gain the same level of security provided by public-key cryptographic schemes will be substantially decreased (J.T. Isaac, 2014).

Possible Scenarios

Wait & See: This scenario pursues the existing path; mobile carriers, financial institutions, payment suppliers and others investigate the establishment of different payment services in certain geographic markets. The restricted partnership between contrasting industries and limited scale will probably suppress services, tear apart offerings, and concentrate on niche markets.

Fly Solo: In this scheme, one player with remarkable market power invest for development stimulation. In order to perform over the industry boundaries, the market leader should handle essential risks and gain the required licenses.

The Buddy System: There will be an alliance between a mobile network operator and a financial institution to establish payment service in which a credit or debit card is associated with a mobile application (computerweekly.com, 2002).

Open Federation Alliance: In this scenario, mobile network operators, financial institutions, merchants, mobile device producers, chip makers, and application developers would come together on a regulated platform to establish a range of financial services on mobile devices. A Trusted Third-Party Manager (TTPM) plays the critical role of coordinator and integrator, controlling both the platform technical features and the ruling business models (SmartCardAlliance, 2006).

Conclusion

In conclusion, a wrap up of the findings, limitiations of the study, proposed solutions and recommendations for future research is presented.

Core Findings: According to the obtained results and numbers, it can be inferred that payment channels are converging more and more together, fading the rigid separation between e-commerce, mobile, and physical retail environments. Retail channels are also merging together which reinforces the usage of mobile online

purchases and payments that is Mobile Commerce. Notwithstanding with the fact that conventional credit/debit cards still have a considerable share of electronic payments, the future move in the payment evolution is represented by Mobile Wallets. There are developed a numerous loyalty and reward programs to incentivize the customer adoption; However, it is still to identify and clarify how the emerged platforms and mobile technologies should cooperate to maximize the stakeholder's benefits. To achieve these goals, the role of entrepreneurial ecosystem is of utmost importance. The startups can boost the electronic payment progress like a power engine by their innovative services. In the meanwhile, their performance should be monitored and evaluated by the right metrics and supported by the improvement programs and complementary sources which is the responsibility of the policy-makers.

In this study, the methodology of the census has been updated from several perspectives. These improvements refined the research boundaries to have a better understanding of the scope of the work. Not only did this generate better interpretation of the obtained numbers which resulted in an improved comprehension of the whole industry, but it also made it possible to identify more credible future trends. Consequently, it could give a better idea to both incumbents and future possible entrants of what they must be focused on for their future investments and how they must manage their developments and services.

Limitations: First, missing data is inherent in the Crunchbase because the information on this website is provided by the startup owners and the credibility of the data is not a hundred percent guaranteed. In addition, there is an innate tolerance associated with the Crunchbase search engine and the categorization of the startups.

The third shortcoming is related to the methodology is the static nature of the analysis. That is, the timeline of the data is not considered in the analysis. For instance, the time of the availability of funds is not considered. For sure, this kind of analysis required the assumption that the inserted data are precise and accurate.

The fourth shortcoming was identified during the literature review. Literature lacks the analysis of mobile payment and startup together. The research studies are often focused on the analysis of one of the two; However, any organized and concentrated study work that analyses the interconnections and bilateral impressions of the two topics on each other could not be identified.

Recommendations for Future Research: For resolving the problem of the missing data, it is strongly suggested to utilize different sources of information and match the data together, as it has been done in the case of Italian startup analysis in this study. Thanks to the Digital Innovation Observatories of Politecnico di Milano, the updated data of the Italian startups could be accessed and analyzed; nonetheless, this could not always be as easy as it seems. It is also recommended that some third-party independent organizations like Digital Innovation Observatory of Mobile Payment to initiate the campaign of gathering the correct, credible, complete and necessary data from the startups, and from their partners to help better understand the ecosystem and its evolution.

For the problem of the innate tolerance of the data, it is recommended to do a sort of due diligence process. That is, double checking the data inserted in the Crunchbase with other available sources like official Website, Facebook or Twitter account of the firm. In case the startups are in the early stages of the development and their contact pages are not updated it is also possible to perform this process via phone call which is again a very time consuming and costly process.

Regarding the methodology, as said by "Lean Methodology", it is always possible to improve the process. One of the improvements that might add in the future, is the dynamic analysis of the funds and creation of the startups. Of course, this analysis has required bigger assumptions on the data; However, the results could be interesting in the sense that how this ecosystem has emerged and how it can evolve in the future.

From the research perspective, it is recommended to define some proposals, preferably practical ones, to be done in the field, and to get the practical data of how these two phenomena could influence each other. The paramount importance of the topic comes from the super dynamic and fast-changing nature of both mobile payment ecosystem and startup ecosystem. Therefore, if the relation between the two ecosystems and their bilateral influences are not analyzed in a precise and timely manner, it may cause some blockages and failures in different parts like failed strategies, not being able to adopt customers, or even obsolete and useless technologies, which further result in the defaults and diminishing of the industry. In this case, it is very recommended to initiate some funded projects supported by policymakers, mobile operators, or regulatory institutions.

CHAPTER 1
INTRODUCTION

By the emergence of mobile phones, the concept of radio connectivity has changed dramatically. The new smartphones are designed and supplied with numerous functionalities which exceed the needs of just being in contact. Consequently, they may trigger the advancement of the value-added services, accessibility usage concept, and the use of the mobile in commerce. In fact, high volume of the cell phone in use, make it an unbeatable technical device that gives it the unparalleled opportunity for marketing, sale, production and delivering goods and services to the final consumers. On the other hand, merchants and providers of the services have an unprecedented chance to kick-start their new business model.

Delivered goods and services must be paid back at the end. At first, the fixed line billing system was modified to charge mobile lines. Then, a mobile billing system has been introduced However, this kind of payments had several issues and constraints. These restraints were including high payment transaction fees, complaints about unfair revenue sharing between the service provider and merchants, and the necessity of the allocation of services to the billing system (M. Peirce, 1999) (H. Tewari, 2003).

In geographical areas like the European Union, credited payment services to third parties require a (limited) credit institution license. Thus, a huge necessity for an appropriate payment instrument has been felt since long time ago, and the absence of

such an instrument was considered a big factor which impedes the progress of mobile commerce (Dahlberg, 2008).

To understand the essence of this research, one should pay attention to two topic trends, which according to the pieces of evidence are among the hottest topics of the era in which we are living in.

The First phenomenon is Mobile Payment. Depicted in figure 1-1 is the trend of this topic in the last five years (Google a. , 2019).

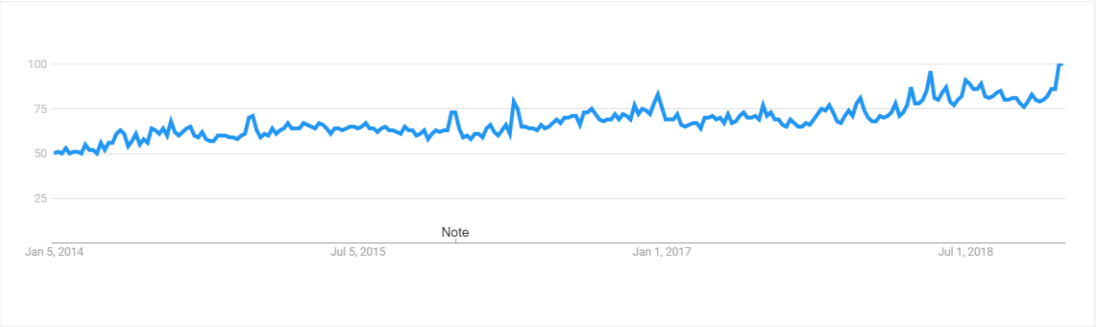

Figure 1-1 Five years trend of Mobile Payment

As it can be seen from the above figure, there's a continuous increase, sometimes with a not so deep slope, which at the end caused the almost double quantity of the demand. There is a note in the middle of the graph, pointing out the beginning of the year 2016, in which Google has made an improvement to its data collection system.

On the other hand, there is another so-called Megatrend about Startup company. The comparison of two is shown in figure 1-2 (Google b. , 2019).

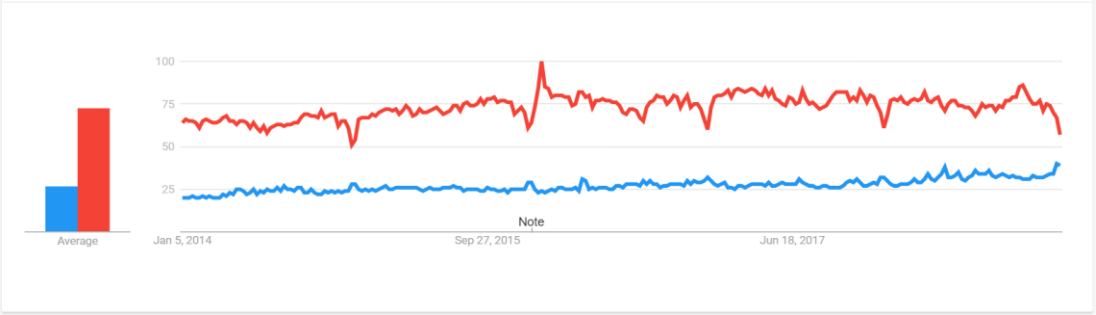

Figure 1-2 Trend of the Startup compared to mobile payments in the past five years

It can be clearly seen that these trends are going to get more attention in the near future and by emerging startups in the mobile payment field, this business will boom. In the next sections, such phenomena will be presented more scientifically.

1.1 Conceptual Background

There is a diverse range of characteristics, aims, and structures for the financial services that are delivered by mobile technology. Depending on the different typologies of these elements, they may have the features of the banking, which is called mobile banking, or transaction payment features which then will be called mobile payments. They can also represent the features of the money, which consequently will be called mobile money. By the way, the definitions and the borders of these categories are overlapped and is not so crystal clear.

There is a relatively huge misunderstanding of the term of mobile payments. Sometimes it refers to bill payments, or a money transfer between ordinary people or entities, or a buying payment. To support a literature review, one good conceptual basis is required to shed light on the inappropriate definitions. Thus, it is presented some definitions here below that will be used later during the second chapter on the literature review (Laukkanen, 2008).

Mobile transactions

The mobile transaction is referring to the transactions executed by means of mobile technologies and devices. In addition to mobile payments, it consists of every type of mobile transaction offered by technology, whether it engages financial values or not.

Mobile payments

Mobile payments include payments that have been carried out through digital mobility technologies, by cell phones, and with or without the use of mobile telecommunications networks. These kinds of payments are digital financial transactions, nonetheless, they may not be connected to financial institutions or banks. There exist different models of mobile payments such as Mobile banking.

Mobile banking can be defined as a series of banking services, through a cell phone that is connected to telecom networks which permit the customers to different kind of

transactions linked to their bank account. The traditional bank can be or not be involved in this process.

Mobile money

Electronic money has characteristics of mobility and portability and is the same as mobile-money or mobile-cash.

It can be distinguished from other types of electronic payments such as credit cards, debit cards, etc. because it has the potential to represent the key features of traditional money like liquidity, acceptability, and anonymity.

Mobile money may be linked to a mobile wallet, which will be defined as a digital treasury of electronic money specifically designed and configures for mobile devices. Mobile wallets permit the customers peer-to-peer transactions (P2P) between mobile devices (M2M) from users of the identical service. It is the same as a normal physical wallet and is able to deposit money and different kind of cards in the same place (Diniz, 2011).

1.2 A Historical Overview

The history of the research in the mobile payment dates to 1997 when the first transaction has been done by Mobile. Coca Cola has launched an experiment by vending machines in Finland in which the payment was accepted by SMS (Tomi Dahlberg, 2015).

Ten years later, numerous researchers around the world who were doing a lot of researches in various countries arrived at a point in which a future direction necessity was felt, in order to address completely every aspect of the topic. Because till that moment, most of the research had been done only on the two main aspects: *technology* and *consumer adoption.* The interesting point was that very few people were able to try the technology. Regarding the convolution of the topic, it was no chance to fully comprehend the causes (Tomi Dahlberg, 2015).

To put light on the concept, it has been presented a definition in 2008 (Dahlberg, 2008) in which *Mobile payments* were defined as “payments for goods, services, and bills with a mobile device by taking advantage of wireless and other communication

technologies". Also, they expressed that "a mobile payment is carried out with a mobile payment instrument such a mobile credit card or a mobile wallet".

By this definition, a difference between mobile payment and other electronic payments or mobile money has been created. They also created a multi-dimensional framework based on this definition to describe the market. Their framework is including two main parts (Dahlberg, 2008):

i) the mobile payment service market based on Porter's Five-Forces model

ii) the contingent factors impacting markets based on general contingency theory

From 2008 till now, hundreds of researches, articles, and journal papers about this topic have been published in which the new or modified definitions have been proposed. Some investigated the important factors of customer adoption and service acceptance which are the "security" and the "trust". Others tried to give theoretical definitions and contributions.

One important point that should be noticed here is that customer adoption is consisting of a big part of the research topics in the field; However, there is a debate on that if it is necessary to continue doing this kind of researches which give a few insights or relying on the pragmatic customer data about their behavior and tendencies can be more appropriate to achieve. In other words, is the reason for doing so is only that journals are still accepting those kinds of studies? If yes, what would be the consequences and the indication of this approach to the industry and how it is possible for the researchers to improve their studies on mobile payments.

Another issue is that as mobile payments become more and more popular, their ecosystem is also enlarging. The participation of financial institutions in this ecosystem is very important. Notwithstanding the rapid improvement, it still remains comparably low. Therefore, the reasons should be discovered and examined why some financial institutions choose to, or not to, participate in this very young mobile payment ecosystem (Du, 2018).

1.2.1 Mobile Payment History

As mentioned above, mobile payments are the payments for the services, products, and bills which are handled through a mobile device like mobile phone,

smartphone, or a personal digital assistant (PDA) by means of the telecom technologies such as wireless.

Mobile devices may be used in a diverse range of frameworks like the acquisition of digital contents such as ringtones, themes, applications, music, news, etc. or buying the tickets, parking fees, transportation cost, and for getting access to electronic payment services to pay bills and invoices. It is also possible to pay for physical goods both in vending machines and in automated or human controlled point of sales (POS) terminals.

Mobile payment will be done by means of a mobile payment instrument like a credit card or a mobile wallet. Besides pure mobile payment instruments, most of the electronic and physical payment instruments are also mobilized. In addition, one can consider two main categories for mobile payments: daily purchases, and bills (credited payments). For daily purchases, mobile payments are a complement or a rival for cash, cheques, credit and debit cards. For bills payment though, they namely give access to account-based payment instruments like money transfers, internet banking payments, direct debit allocation, or electronic invoice reception (Dahlberg, 2008). Mobile payment services became a hot topic in the early 2000s. Hundreds of mobile payment services like access to electronic payments and Internet banking were introduced all over the world. Surprisingly, many of these efforts failed. For instance, most of the dozens of mobile payment services available in EU countries and listed in the ePSO database (Carat, 2002) have been discontinued.

To ease the development of better mobile payment services, it is important to analyze the history by learning what previous studies have unearthed about mobile payments services and markets, alongside what issues have remained unanswered (Dahlberg, 2008). In the next chapter, it will be presented an extensive literature review on the three most influential subjects of the mobile payment research which are strategy and ecosystems, technology, and adoption. Also, will be presented a brief overview of the startup ecosystem.

CHAPTER 2
LITERATURE REVIEW

In this chapter, an intensive literature review on the three most influential subjects of the mobile payments will be presented. Furthermore, different aspects of the ecosystem will be described and analyzed whenever is possible.

2.1 Mobile Payments Strategy and Ecosystems

Technological environment and customer adoption historically have been received more academic attention; However, the academic contributions were restricted and did not help a lot to the advancement of mobile payments during the past years. That was the reason for the failure of the most the mobile payment attempts even before the consumers and merchants got acquainted with them. On the other hand, the appearance of the multi-level and multi-aspect research on the ecosystem and strategy of the mobile payment platforms in recent years could finally resolve some important issues.

Back in 2005, multi-aspect researches have been proposed by some researchers reasoning that concentrating only on one single perspective could not fully explain such a complicated phenomenon like mobile payment. (Dahlberg, 2015)

One of the early researches suggested a framework called “technology environment assessment” framework which puts together three complementary aspects namely the market, the actors, the issues (Ondrus, 2005).

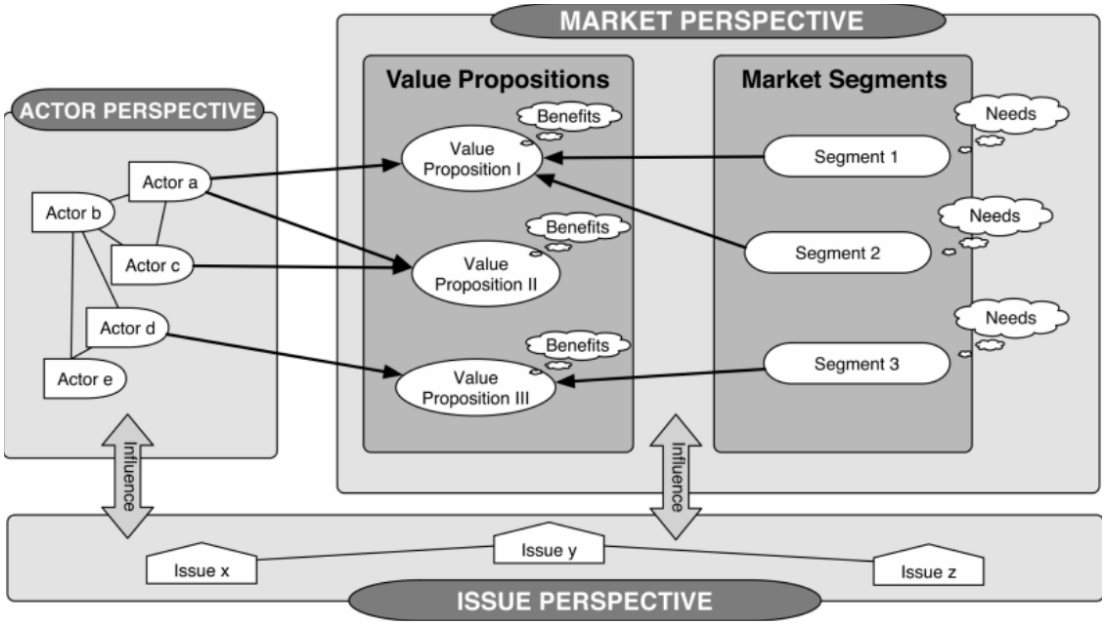

Figure 2-1 Multi-perspective technology envir. assessment FW (Ondrus, 2005)

According to their research, the market perspective will analyze the ability to create and maintain a profitable relationship with the customers by means of providing a relevant value proposition alongside customer needs. The actor perspective though examines the role of the actors, the ecosystem structure, and the conditions of the competition and economics. The issue perspective is considering the future uncertainties related to the mobile payment such as the shape of the physical devices, or volume of the payments. They explained how these aspects are linked and as it is illustrated in figure 2-1, they should be analyzed concurrently.

Another possibility is a suggested framework which includes a user adoption perspective like a customer and merchant adoption, and an infrastructure perspective like stakeholder collaboration, regulation, business models to analyze the success of mobile payments. They emphasized that both aspects are equally important and have an intense dependence on each other. Thus, they should be studied together (figure 2-2) (Zmijewska, 2005).

A theoretical framework has been proposed to find out why during ten years of mobile payment failed attempts in Finland, it did not appear a single dominant design, although they had the opportunity to hold international standardization

committees which made efforts in favor of Nokia to take the world market (T. Dahlberg, 2008).

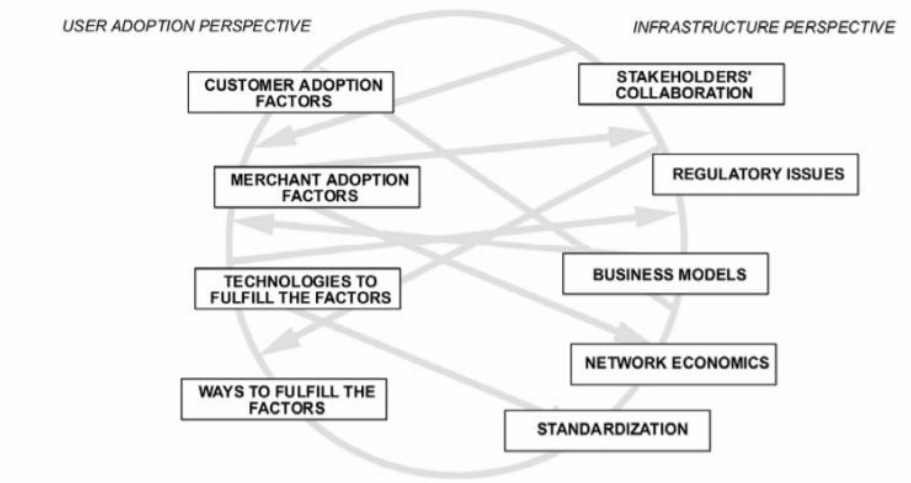

Figure 2-2 Multi-perspective FW for m-payment success studies (Zmijewska, 2005)

Their framework (figure 2-3) was built on theories taken from standardization and market emergence research. They declared that multi-disciplinary and multi-level analyses yield more insights than single theory models. Therefore, their framework on the emergence of mobile payment markets comprised institutional, key market actors, and economic, business and technology factors. (T. Dahlberg, 2008)

Based on some other economic and strategic aspects, (Y.A. Au, 2008) have suggested a framework to recognize relevant stakeholders of the mobile payment ecosystem that is consumers, merchants, technology producers, and regulators. They also proposed some economic theories for analyzing mobile payments.

Their framework (figure 2-4) illustrates different impact levels on the stakeholders by a series of circles inside each other. The innermost circle contains the issues that are related in the most direct way to the technology or innovation that is technological innovations connected to mobile payments such as network externalities and the value of mobile payment transaction-making which seem to impact all the identified stakeholders. The next circle contains the issues which have first-order impacts including revenue increase and cost reduction at the vendor side, and service quality or accessibility benefits for the customer side. The last circle which is the outermost one has the secondary and other ranks impacts. These issues

may affect one stakeholder or more. Determining factors are the setting, the disruptive technology, the nature of the business, and the social problems. This framework is strong and generalizable and can be concerned for diverse technologies like VOIP, radio frequency identification (RFID), electronic auction, etc. (Y.A. Au, 2008)

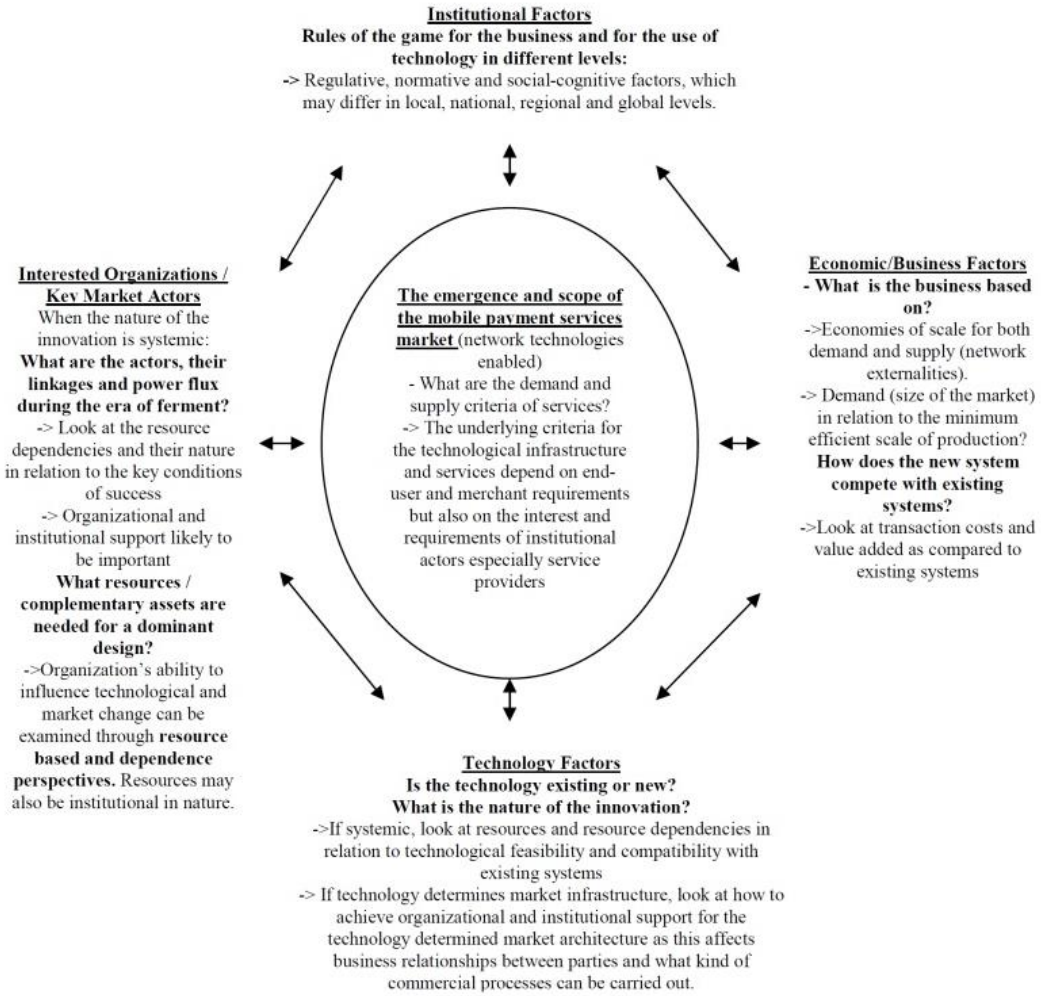

Figure 2-3 Theoretical Framework (T. Dahlberg, 2008)

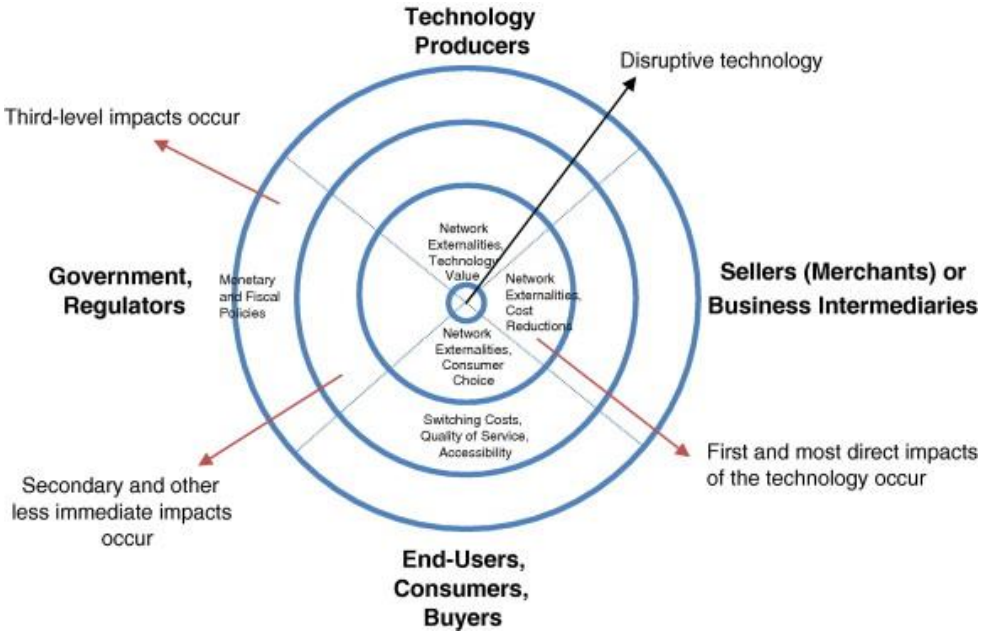

Figure 2-4 Robust FW for economic issues analysis for disrup. techs (Y.A. Au, 2008)

Ondrus tried to understand why mobile payment platforms had failed and given a direction for future architecture design by proposing a dynamic model which covers different propagation stages. In this way, they got rid of the static nature of the previous frameworks and bring inside the idea of time and sequence. Then they applied the proposed framework to explain three failed introductions of mobile payments in the Swiss market. Their analysis suggests the necessity of getting attention to the market-level and behavioral facets in the future for explaining mobile payment propagation. (J. Ondrus, 2009)

Another research tried to show how technological innovations affect payment ecosystems. They elaborated that digitalization of the payments will result in ecosystem instability because of the impact on the different dimensions of the ecosystem like competition and collaboration. That is, the digitalization makes new fields of competition and needs new paradigms for collaboration of stakeholders. (J. Hedman, 2012)

In a more recent study (Magnier-Watanabe, 2014), it is proposed that the successful adoption of mobile payment systems highly relies on fulfilling institutional restrictions found in country-specific environments, rather than conforming with

industry-based and resource-based views. The mobile payments are also examined from the regulative, normative, and cognitive institutional carriers' points of view. Also, Japan has introduced as a case study to illustrate the relevance of the institutional fit with the acceptance range.

Historically, firms from different industries had to negotiate the exchange of their complementary resources and capabilities to provide a mobile payment platform. Even though major efforts to design a satisfying business model to enhance this key collaboration has been done; the difficulties for these inter-dependent firms to form partnership prevented the emergence of successful mobile payment platforms.

As firms are struggling to shape sustainable ecosystems, different industry architectures solving the inter-dependency problem are sought. In some specific architectures, the importance of the banks' role has been investigated.

One of these studies takes a resource-based view on banks to investigate how resources or capabilities grant banks a competitive advantage in the mobile payment ecosystem. The analysis resulted in the identification of strategic assets, owing to which it can be discussed that the banks still have a key role to play in the industry architecture (A. Gaur, 2012). In the table 2-1, these strategic assets are presented.

Table 2-1 Strategic assets of the bank (A. Gaur, 2012)

Strategic Assets	Characteristics
Banking systems	- Limited substitutability - Inimitability - Low tradability - Durability
Bank accounts	- Limited substitutability - Inimitability - Low tradability
Brand image	- Limited substitutability - Inimitability - Low tradability

To analyze the strategies of market actors another framework has been proposed by Kazan, which investigated three cases by means of multi-sided platform theory. According to their study, the key factors for a payment platform to be feasible are

network effects, bundling, and switching costs (Kazan, 2013). Later, they upgrade this framework to consolidate different aspects like technology, business design, and the platform together (Kazan, 2014).

The emergence of the new important market actors like Google, PayPal, Apple, and Alibaba in the mobile payment market, intrigued the new researches to examine how they will affect the technology ecosystem. Particularly, they investigated mobile payment solutions from third parties (Ondrus J. L., 2011).

In the route to discover how young payment markets appear, Ozcan demonstrated how firms from diverse industries have difficulties to reach an agreement on the mobile payment market structure which further led to the suspension of resource allocation. They discovered that the engaged firms had been a dominator in their industry and missed collaboration experience (P. Ozcan, 2014).

In figure 2-5, types of players active in mobile payment services are illustrated. As an example, it is interesting to note that the nature of the activity, making NFC-based payments from a mobile phone, needs different parties from diverse industries to be engaged. First, mobile phone maker like Nokia is needed for manufacturing NFC-compatible cell phones. Second, mobile operators like Vodafone needs to permit mobile payment software as part of its wireless package. Third, banks and financial institutions like Bank of America, Visa, MasterCard need to provide access to the subscribers' financial account and supply the financial license to approve payments. Fourth, the NFC chip is needed by hardware providers like Phillips, Gemalto. Fifth, application to manage the financial account over the phone like E-wallet is needed from software providers like Vivotech. Sixth, additional software is needed for downloading the users' personal data to each phone (Over the Air) and for guaranteeing security and privacy of every single transaction like Giesecke and Devrient. Seventh, Point of Sale (POS) terminals are needed to be provided by hardware providers like CCV Holland or Vivotech in places where mobile NFC-payment would take place. Finally, merchants like 7-Eleven, Macy's, McDonald's are needed to allow NFC payments and install POS terminals in their stores. The commercialization of the NFC technology required these players to agree

on a market architecture for role division and value appropriation (Ondrus J. L., 2011).

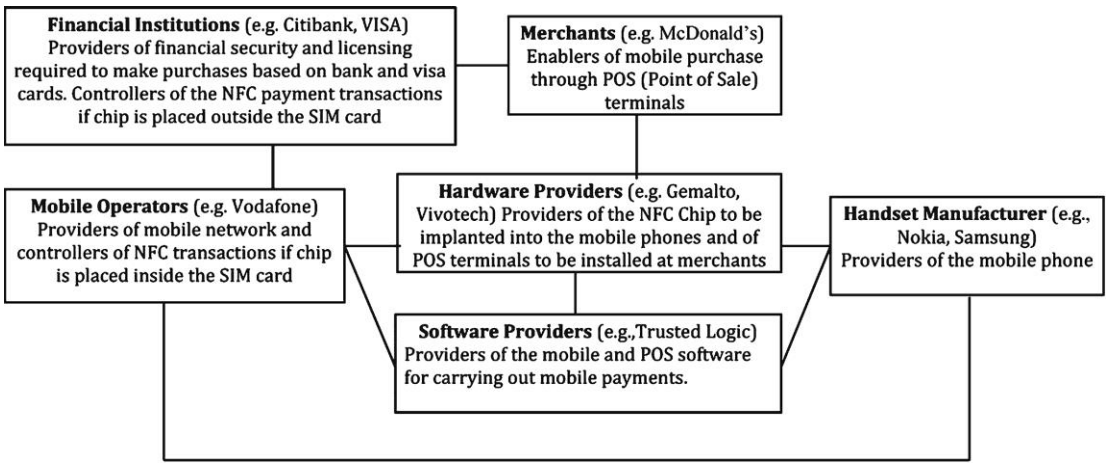

Figure 2-5 Types of players active in mobile payment services. (Ondrus J. L., 2011)

To demonstrate cooperation strategies in the mobile payment ecosystem Hedman proposed a multi-level framework which consists of micro, meso, and macro levels. Their framework was based the theories of market cooperation, technology ecosystem, and business ecosystem. They also have done a validating case study in Denmark. Finally, they concluded that "technology-based market cooperation strategy in mobile payment ecosystems can be understood as a balance between defensive and offensive technology-based strategies" (J. Hedman S. H., 2015).

The effect of the openness strategies on the potentiality of the market has been explored by using a multilevel framework. They conducted their research based on the different cases of mobile payment markets. They demonstrated that before launching a mobile payment platform a diverse range of strategic, technological, and user-related decisions must be made to extend the borders of its diffusion potential. Obviously, these conditions are necessary but not enough to secure the success of the platform (J. Ondrus A. G., 2015).

Another framework has been proposed to recognize the optimal entry and expansion strategies of digital payment platforms. Based on this framework, scheduling the best time of entry and expansion decisions has a big impact on the platform success. And

not doing so, could result in the loss of any previously gained competitive advantage. (K.S. Staykova, 2015)

Up to now, it can be figured out that several recent studies have mainly confirmed the results of prior mobile payment ecosystem studies. Similarly, the reasons for the failures of m-payment platforms have been identified as a lack of collaboration between multiple stakeholders, difficulties in finding win-win business models and the lack of standardization.

Despite some similar findings, the more recent articles are generally more powerful in terms of theory and practice. Obviously, the reason for this progress is that researchers have adopted established models and theories from other literature, such as the multi-sided platform literature, strategic asset theory, and collective action theory. Similarly, the new case studies are more constructed, as more data has become publicly available. Therefore, it seems that to have a holistic vision it is a necessity to approach in different levels and aspects in mobile payment ecosystems. In particular, the main themes of the researches in this field are mostly about the research topics like “Multi-perspective framework for mobile payment ecosystems”, “Framework to identify the actors and their role”, “Analysis of the business models”, “Study of strategic issues”. (Dahlberg, 2015)

It should be noted that the researches done on the ecosystem of mobile payment are not systematically built on the base of the previous works, although they may have indistinguishable perspectives. The reason behind this may lie down in the conversion feature of the technology or the absence of eminent mobile payment ecosystems. Also, incompleteness and innovative nature of the research field can cause the existence of the different frameworks for investigating the mobile payment ecosystems. (Dahlberg, 2015)

2.2 Mobile Payment Technology and Technological Environment

Senior management strategists and financial services leaders are required to put a special consideration on the unique point of view provided by the economic theory

of emerging technologies, from which is possible to investigate related issues to those technologies. Mobile payment is a new technology application around the world, that is associated with the revolution in wireless connectivity. (Y.A. Au, 2008)

To better understand the research topics and directions in this category one may divide the analysis into two different periods: before 2007, and after 2007. There has been done an extensive amount of research on the technology category during the period between 1998 and 2006 according to (Dahlberg, 2008), and this popularity of the technology and technological environments also continued in the next years.

The technology studies were done before 2007 were so dispersed. This feature also continued after with a new crack that is security which became an obvious dominant topic. Roughly over three fourth of the papers focused completely on the security topic and the remaining researches gave some sections on the security problems. (Dahlberg, 2015)

In the table below will be presented the twenty most popular topics of technology and technological research.

Table 2-2 Technology & technological envir. research topics (Dahlberg, 2015)

No.	Name of the topic	No.	Name of the topic
1	Security including privacy	11	Non-repudiation technology
2	Message protocols	12	E-Payment technology
3	Security Proofs	13	Secure protocols
4	PKI/WPKI/Public key; symmetric key	14	3D secure and its modifications
5	Authentication	15	Mobile financial services technology
6	Electronic coin; electronic cash; electronic money technologies	16	RFID
7	Mobile payment protocols	17	NFC
8	Micro-payment technology	18	Proxy certificate
9	Trusted device	19	Technology performance evaluation
10	Cryptography	20	Restricted connectivity

As it can be seen from the table above, although there have been conducted a lot of researches on only one topic of security and it seems to be one dimensional research category; However, the whole research domain is still fragmented and focusing on the security topic did not stop other topics from coming to the existence. On the other hand, the security had a strong impact on the other topics though, that is, for example, a typical part of the "message protocols" which is the second most popular topic is consist of security messages. (Dahlberg, 2015)

Among all, there is one special stream of research, which started from lightweight security with restricted connectivity schemes. Restricted connectivity addresses the cases in which the payer at the moment in which transaction is going to be executed, has limited or no online access to the merchant or the bank. The topic has started over a decade ago (K.-Y. Lam, 2003), and continued over the years by the related works (M. Hassinen, 2008) (W. Li, 2012).

By merging and completion of the previous works, it has been presented the design and implementation of an anonymous secure payment protocol based on the payment gateway centric scheme for mobile environments where the customer cannot communicate directly with the merchant to process the payment request. The proposed payment protocol uses symmetric-key operations because these operations require low computations. It has been also presented a performance evaluation of the proposed payment protocol in a real environment. (J.T. Isaac, 2013)

By comparing alternative technological solutions, one may find different themes in this field of work. These themes are summarized in the table below. As mentioned previously, the wireless technological revolution has enabled mobile devices to become a critical element of the new digital economy, in which customers carry out transactions while on the move.

To be able to compare alternative technological solutions, it is needed to define very precisely some technical terms to facilitate the concept that is going to be discussed. The worldwide diffusion of the Internet led to the emergence of *electronic commerce*, a business environment that permits the electronic transfer of transactional information. Electronic commerce main characteristics are including the openness, speed, anonymity, digitization, and global accessibility of the Internet,

which make it smooth real-time business activities, such as advertising, questioning, negotiation, auction, ordering, and paying for goods and services.

The major concern with electronic payment is the level of security in every step of the transaction because money and merchandise are transferred while there is no direct contact between the two sides involved in the transaction. If there is even the slightest possibility that the payment system may not be secure, trust and confidence in this system will begin to weaken, resulting in destroying of the infrastructure of the electronic commerce. (H.-C. Yu, 2002)

Mobile e-commerce accounts for a natural supplement of e-commerce and symbolizes a new way of coordinating the commerce. Mobile commerce engages e-commerce transactions executed through a mobile device via wireless networks.

The electronic payment performed in wireless environments generates the term *mobile payment (or m-payment)*, which is defined as any payment transaction involving the purchase of goods or services that is completed with a wireless device. M-payments makes m-commerce smoother because they permit users to make online purchases from their mobile devices remotely at any time. (M. Niranjanamurthy, 2012)

By the emergence of other innovative technologies like fifth-generation of the mobile networks (5G) and cloud computing, the mobile payment systems have become fully integrated and the new challenges need to be addressed for the future. In particular, issues like threats, vulnerabilities, and risks related to such systems as well as corresponding protection solutions to mitigate these risks should be taken into deep consideration.

Although there has been extensive work on the security issue of the technological side of the mobile payment, the view of the topic still remains fragmented. According to Dahlberg, one of the reasons could be publishing technology articles at particular times may address technologies from different generations of mobile networks, mobile devices, SIM cards, POS terminals and other technology components used in a mobile payment service (Dahlberg, 2015). On the other side, the researches may have examined different payment scenarios. A *payment scenario* may describe but not limited to one of the different cases mentioned below:

- Peer to peer micropayment money transfers.
- Proximity payments at vending machines with diverse short-wave radio frequency technologies like NFC or RFID.
- The use of pass cards or mobile device swiping in public transportation.
- Payments with mobile money, mobile wallets or mobile credit cards at the POS in shops or as purchases from electronic commerce or application stores in a remote way.
- Mobile banking payment services in terms of micropayments and macropayments of purchases and electronic invoices.
- Payments executed by network billing applications of mobile network operators.
- Payments executed by service billing applications of mobile service operators.

Besides payment transaction handling, it is crucial to consider how to: prevent fraud; achieve secure acknowledgment; and processing of unconfirmed, invalidated, and restrained transactions with transaction rollback (Dahlberg, 2015).

Owing to the fact that security requirements like identification, authentication, security protocols, messaging, and data encryption, vary for each technology generation and layer and even for each type of payment scenario; consequently, the literature will be shattered. Thus, someone might consider carefully the constitution of the underlying technology, and the payment scenario of each article.

These characteristics of the technological researches result in an inevitable difficulty in establishing a holistic view of the technologies that have been utilized in mobile payments and how these technologies help to handle different payment scenarios. On the other hand, dominant technologies used in most popular payment services like Google Wallet or PayPal are not addressed well and that may because of tendency of these tech giants to reveal their detailed secrets.

The speed of technology development used in mobile payment services is also considered as a determining factor that should be addressed more often in the literature. For instance, the changing speed of technologies related to network infrastructure such as the shift from 3G to 4G is close to ten years or longer yet.

Merchants should replace their POS terminals every three to seven years, meanwhile, the lifecycle of mobile and smartphones is typically from six months to two years on average. Accordingly, establishing a security and trust protocol associated to a payment scenario for a specific mobile device makes little sense if that device is going out of the market after one year, except if that protocol can be easily adjusted to other devices. (Dahlberg, 2015)

In the table 2-3, there has been presented a summary of the different research categories recognized in the field of technological research.

Table 2-3 Technology & technological envir. research themes (Dahlberg, 2015)

No.	Category
1	Proposals of m-payment systems
2	Proposals of tools or mechanisms for m-payment transactions
3	Proposals of protocols for m-payment transactions
4	Proposals of tools or mechanisms for security and trust
5	Technology descriptions with a focus on security and trust
6	Technology descriptions of m-payments
7	Semiconductor elements, SIM cards, antennas

2.2.1 Mobile Payment Systems

A *mobile payment system (MPS)* can be defined as any payment system that authorizes financial transactions to be conducted securely using a mobile device, from one organization or individual to another over a mobile network. M-payment has offered tempting opportunities to financial institutions, merchants, and users including the simplicity and ease of transaction for the user; they also enable merchants to access customer information and use that information for targeting, couponing, incentive and reward programs to specific customer groups (T. Halonen, 2002)

Accordingly, there are some specific criteria for designing and implementation of such systems including Functional and Technical, Security, Stability and

Performance, Modularity and Maintainability. The figure 2-6 demonstrates the Mobile Payment System concept in a sequential diagram from the buyer point of view. In this schematic, the money exchange is not depicted, and this is because the Mobile Payment System is not actually conducting money traffic. That is, it only registers and forwards the authorized and validated payment transactions. (T. Halonen, 2002)

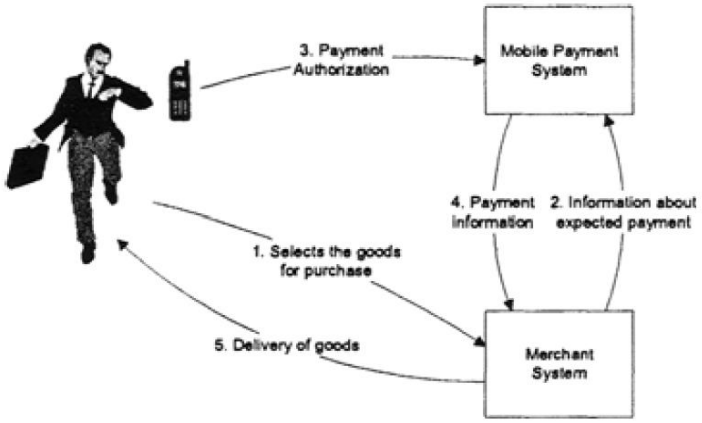

Figure 2-6 The Mobile Payment System conceptual scheme (T. Halonen, 2002)

The major elements of an m-payment system and their interconnections for conducting an m-payment transaction are depicted in figure 2-7. As it can be seen from the figure, a typical m-payment system is composed of four main entities: the client, the merchant, the merchant's financial institution which is called the acquirer and the client's financial institution which is called the issuer.

The client and the merchant can be connected by a short-range link or the Internet using wired, wireless, or cellular communication technologies that are offered by a cellular phone operator like General Packet Radio Service (GPRS), Enhanced Data Rates for Global System for Mobile Communications (GSM) Evolution, Evolution-Data Optimized, or High-Speed Downlink Packet Access (HSDPA) (J.T. Isaac, 2014). On the other hand, there can be also a payment gateway in an m-payment system which is an additional entity acting as an intermediate for payment-clearing

goals between the acquirer and the issuer on the bank's private network side and between the client and the merchant on the Internet side (J.T. Isaac, 2010). Unlike the connection between payment gateway and the merchant or the client that can be of different types such as wired, wireless or cellular; the connections among the issuer, the acquirer, and the payment gateway typically establishes by the private (wired) networks of banks, and the communication will be secured using famous security protocols such as Secure Socket Layer/Transport Layer Security.

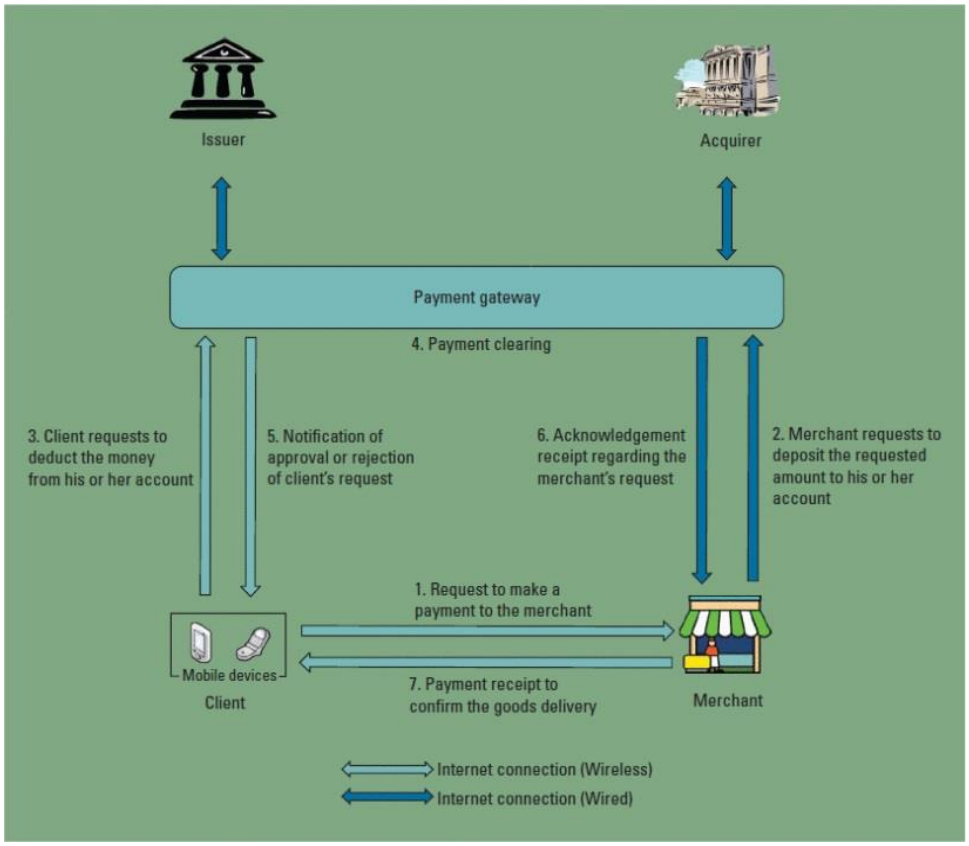

Figure 2-7 Entities of an m-payment system and their interactions (J.T. Isaac, 2014)

2.2.2 Mobile Payment Classifications

Mobile payment systems can be classified in different ways from which one of the internationally accepted ways is as follows:

- *a remote payment*, where the user makes a payment using a mobile device to access the m-payment back-end system via mobile communication networks, or
- *a proximity payment*, where the user makes a payment using a mobile device and short-range communication technologies. (P. Wang, 2012)

It can also be considered a broader m-payment categorization based on a wider range of criteria including:

- The basis of payment or how the money is transferred;
- The payment medium to be used to realize the payment;
- The timing of payment or when it occurs;
- The payment amount conveyed from the customer to the merchant; and
- The payment location, that is where the payment takes place.

Table 2-4 demonstrates the classification of the Mobile Payment Systems based on the abovementioned criteria and presents 14 different methods that have been derived from these categories.

The table 2-5 will wrap up the Client-Side technologies which are used to implement the mobile payment on the client side. One should notice that some of these technologies are still emerging and immature (J.T. Isaac, 2014).

Table 2-4 M-payment Methods (X. Zheng, 2003)(W. Guo, 2008)(Ramezani, 2008)

M-Payment Criteria	Methods
Payment basis	*Account-based*: each user is associated with a specific account maintained by an internet payment provider (IPP) and is periodically billed and pays for the balance of the account to the IPP.
	Token-based: an electronic token is the medium of exchange representing a monetary value, usually supported by a bank. Customers convert actual currency to an electronic equivalent with their issuer before making a transaction. A merchant collects the tokens and sends them to the acquirer to redeem the money.
Payment medium	Mobile payment by *bank* account or credit card: with or without direct access to the card during the payment.
	Mobile payment by *phone*.
Payment timing	*Prepaid (debit)*: customers pay in advance to get the goods and services they want.
	Prepaid (debit): customers pay in advance to get the goods and services they want.
	Postpaid (credit): customers will get the goods or services before they pay for them.
Payment amount	*Picopayments*: for transaction amounts less than a $0.10.
	Micropayments: for the amounts between $0.11 and $10.
	Macropayments: for the amounts above the $10.
Payment location	*Remote transactions*: which is handled by complete freedom of user location.
	Proximity transactions: where the mobile device communicates locally with other devices using short-range communication technologies.

Table 2-5 Client-Side technologies of M-payment (J.T. Isaac, 2014)

Technology	Short description
Short Message Service	This service allows mobile systems and other networked devices to exchange short text messages with a maximum length of 160 characters.
Unstructured Supplementary Services Delivery	This session-based, transaction-oriented technology is unique to GSM and refers to the capability built into the GSM standard for supporting the transmission of information over the GSM network's signaling channels.
Wireless Application Protocol/GPRS	GPRS is a mobile data service available to GSM users that enables WAP-enabled devices such as mobile phones to support services such as Internet browsing, multimedia messaging service, and Internet-based communication services such as email and World Wide Web access.
Phone-Based Application	The m-payment client application (residing on the consumer's mobile phone) can be developed using the Java 2 Platform, Micro Edition for GSM-based mobile phones and the Binary Runtime Environment for Wireless for mobile phones based on code division multiple access.
SIM-Based Application	The Subscriber Identity Module (SIM) used in GSM mobile phones is a smart card whose information can be protected using cryptographic algorithms and keys. (Smart cards are microcomputers small enough to fit in a wallet or even a mobile phone. They have their own processors and memory for storage.) SIM applications are relatively more secure than client applications that reside on the mobile phone.[14]
RFID	This technology uses radio frequency (RF) signals to exchange data between a reader and an electronic tag attached to an object, for the purpose of ID and tracking.
Near-Field Communication	This short-range wireless communication standard results from the fusion of the contactless smart card (RFID) and the mobile phone.[15]
SIM Application Toolkit	This technology allows the configuration and programming of the SIM card.
Voice-Based Payment Transactions	These can be done by making a phone call to a special number and providing a credit card number.
Dual Chip	Dual-chip phones have two slots: one for a SIM card (telephony) and another for a payment chip card. This solution allows an m-payment application provider to develop an m-payment application in the payment chip card without collaborating with the telecommunications operator (the owner of the SIM card).
Mobile Wallet	This m-payment application software on the mobile phone contains details of the customer (including bank account details and/or credit card information) that enable the customer to make payments using the mobile phone.

2.3 Mobile Payment Adoption

As mentioned previously, the mobile payment adoption researches focus is specifically on customer adoption. Identifying the customer preferences and the causes that will result in adoption or not to adopt a specific technology enable service is essential to design services which originate value to both the users and stakeholders of the ecosystem.

In the researches that have been conducted prior to 2007, different information technology adoption models had been used such as technology acceptance model (TAM), the unified theory of the acceptance and use of technology (UTAUT), and the diffusion of innovation theory (DOI). Beside the features of these models, some other characteristics like trust, security, and cost have been considered of utmost importance in the adoption decision process of the mobile payments. (A. Zmijewska, 2004)

This procedure has been continued in the next years by using not only the previously mentioned theories but also some other diffusion theories like *task-technology fit* (TTF) *theory*, the theory of reasoned action (TRA) and the *theory of planned behavior* (TPB). It should be noticed that this continuation of the work on customer adoption have approved the earlier findings in previous studies for sure with better practical data and statistical analysis thanks to the advancement of the analysis tools (Dahlberg, 2015). According to the analysis, the following table contains the list of the key adoption factors extracted from the literature.

Table 2-6 Key adoption factors (Dahlberg, 2015)

No.	Factor	No,	Factor
1	Perceived ease of use	**2**	Perceived usefulness
3	Trust	**4**	Risk
5	Demographic	**6**	Security
7	Compatibility	**8**	Social influence
9	Mobility	**10**	Convenience
11	Subjective norm	**12**	Personal innovativeness

13	Habit	**14**	Privacy
15	Self-efficacy	**16**	Quality
17	Experience	**18**	Payment
19	scenario	**20**	Income
21	Image	**22**	Knowledge
23	Satisfaction	**24**	Uncertainty avoidance
25	Technical impulse	**26**	Complementarity
27	Complexity		

By looking at table 2-6 one can understand the top two factors belong to the technology adoption model, followed by the trust and the risk. It is visible that the security is also one of the most important factors ranked sixth. And placing demographic in the fifth place is very interesting and shows the importance of this factor.

The recent works beyond the traditional customer adoption factors have also utilized the other methodological approaches like design science methodology, interviews, survey questionnaires to get the pragmatic data and analyzing them by innovative statistical methods; consequently, not deriving the actual interpretation of each customer adoption factor or their relationship between each other.

For instance, as mentioned before *perceived ease of use* has been recognized as one of the most important adoption factors for mobile payment services; However, there is no confident evidence of what the meaning of ease of use is or how it can be compared between different services. This general interpretation of the most adoption factors is somehow contrary to the real case mobile payment scenarios. Because in the real world, the mobile payment is on the alternatives of the payment rather than to be the only alternative. (Dahlberg, 2008)

In a more innovative work (Alshare, 2014) examined the effect of accepted national cultural values on consumer's intention to use mobile payment devices using the UTAUT and Hofstede's cultural dimensions as the basis for the research framework. The regulating impact of espoused uncertainty avoidance espoused power distance, espoused collectivism, and espoused masculinity were investigated. A Structural

Equation Model using a convenience sample from the Qatar population was used to examine the model. Performance expectancy, social influence, and perceived information security have direct paramount effects on consumer's behavioral intention to use the mobile payments. The adopted national cultural values of uncertainty avoidance, masculinity, and collectivism have weakening impacts on the hypothesized relationships. For instance, social influence is a more powerful predictor of consumer's intention for individuals who adopt collectivism cultural values.

In another study (Y.-H. Cheng, 2013) investigated high-speed rail (HSR) passengers' approval of mobile ticketing services, as indicated by use of quick response codes (QR codes) for payment and gate entrance. They contributed to developing a theoretical framework that brings together mental accounting theory and the technology acceptance model (TAM) to analyze consumers' decision to adopt mobile ticketing. Structural equation modeling was utilized to explore the research hypotheses based on the proposed theoretical framework. The analytical results approved practical evidence that a combination of the mental accounting theory and TAM is appropriate for describing passengers' mobile ticketing service adoption. The results showed that personal innovativeness has a positive impact on both mobile access adoption and QR code adoption. Even though perceived risk, perceived usefulness, and perceived ease of use all influence QR code adoption, but mobile access adoption is not directly affected by perceived risk or perceived ease of use. Nonetheless, the perceived usefulness related to such a system has a positive and direct influence on mobile access adoption. besides, regarding the interaction between potential benefit and potential loss of adopting a QR code service it can be inferred that perceived risk not only directly influences passengers' mobile ticketing adoption but also offsets the influence of the construct of "perceived usefulness" on passengers' adoption intention.

In another examination of learning theories (Jia, 2014) investigated IT acceptance from the IT ecosystem aspect. They utilized transfer of learning theories as the theoretical background to examine how technology usage habits affect consumers' tendency to continue using mobile payments. Their findings show that mobile

service usage habit affects consumers' behavioral tendency directly and indirectly through mobile payment usage habit. Besides, consumers' online shopping habit and cell phone usage habit affect their behavioral intention indirectly through mobile payment usage habit.

On the one hand, several alternatives might achieve richer conceptualizations of the dependent variable(s). For instance, one might say postponement of a decision, intention to use later, intention to use in the near future, and steps taken to start the use instead of an *intention to use* mobile payments. On the other hand, it is also possible to form new concepts for independent variables. As an example, it might possible to scale the assessment of each factor from "good to have" to a "vital requisite" grade.

To compare the importance of adoption factors in different payment scenarios, (Goeke, 2010) examined the use of mobile payments to pay parking fees, to take fare tickets and to handle money transfers. For doing so, the Technology Acceptance Model (TAM) was extended by new constructs computing the m-payment particularities like expressiveness and the applicability in different payment scenarios.

A different stream of studies has addressed the adoption factors for different technologies like NFC and mobile wallets in various payment scenarios like mobile ticketing or governmental services' payment. One of the studies introduced the concept of *payment habit*, which maps payment instruments and payment scenarios (T. Dahlberg, 2007). They made a comparison of the choice of eleven payment habits in payments at the point of sales such as the use of cash, credit card or debit cards, a mobile device, etc. and remotely such as the use of electronic banking, credit or debit cards, a mobile device, etc. In particular, they constructed two models in the payment context. One of them tries to model the determinants of the mobile payment services adoption while the other simulates the determinants of electronic invoicing adoption. By the comparison of the two structures, one can be perceived that ease of use sounds to be the least common denominator for consumer adoption of these information technology-based services while the context of technology adoption will

set both the non-differentiating and the differentiating determinants of technology adoption.

Another study examined trust from three dimensions including trust in a mobile service provider, mobile payment vendor, and the technology component and explored the effect of trust on the intention to use mobile payments. The results were based on a survey sample. Findings revealed that trust is an essential factor of consumer's intention to adopt mobile payment. Results also highlighted that features of the mobile service provider, mobile payment vendor, and mobile technology affect the development of trust on mobile payment. Particularly, consumer's perceptions of structural assurance and environmental risks of mobile technology have a crucial impact on mobile payment trust. Results emphasized that consumers' perceived reputation of the mobile service provider and mobile payment vendor are positively connected to mobile payment trust. (Xin, 2013)

In the only qualitative study, with focus group interviews it is been observed that the benefits of mobile payment services might be different than those in established IS adoption models. A mobile payment service is regarded as a mean to behave that is pay for purchases, not as an IS to be taken into use. According to the study, time and place independence, queue avoidance and possibilities for remote payments are perceived to be valuable (Mallat, 2007).

A paper that conducted a design science inquiry into the mobile wallet has considered four different user groups including young teenagers, young adults, mothers, and businessmen to be involved in the process of detection, developing and analyzing functional and design features of mobile wallets. Then the provided data used for the building of a conceptual model in the form of sketches and a functional model in the form of low-fidelity mock-ups. During the design procedure, knowledge was obtained about what properties the users would like the mobile wallet to realize. The detected features have been categorized as 'Functional properties' and 'Design properties', which are theoretical contributions to the research on mobile wallets (M. Olsen, 2012).

In sum, the current challenge of mobile payment adoption research is not in the effort but in relevance. Mobile payments should be examined as dynamically progressing

services rather than IT or IS, in their real-world contexts, where they compete with other payment tools and methods for getting attraction in payment scenarios applicable to these services.

Parallel to the multi-sided platform and ecosystem studies, there is a need for multi-sided adoption studies within identical ecosystems. It also may be possible to investigate the effect of financial and other kinds of incentives and payment fees on preference decisions (Dahlberg, 2015).

2.4 Mobile Payment Business Models and Revenue Streams

One of the important research questions to be answered is what the business value of mobile payment services is and how can it be measured. The participation of different parties in the mobile payment market and their roles is strongly linked to the business value of mobile payment services. To address this issue (Pousttchi & et.al., 2009) proposed an extension to 'Business Model Canvas' of (Osterwalder & et.al., 2005). They have explained the complexity of the M-payment platforms and the importance of taking into account inter-relationship among different factors such as technical, human, and market.

One of the great complexities of the mobile payment is its convergence since it is required that many players and stakeholders cooperate with each other. The necessarily involved stakeholders in the mobile payments value chain are comprised of customers, merchants, acquiring a bank, issuing bank, mobile network operators, chip and handset maker, SIM and software providers, payment network, trusted service manager such as governments and international regulatory agencies (G. Leo, 2011). Figure 2-6 illustrates the framework of the mobile payment value network.

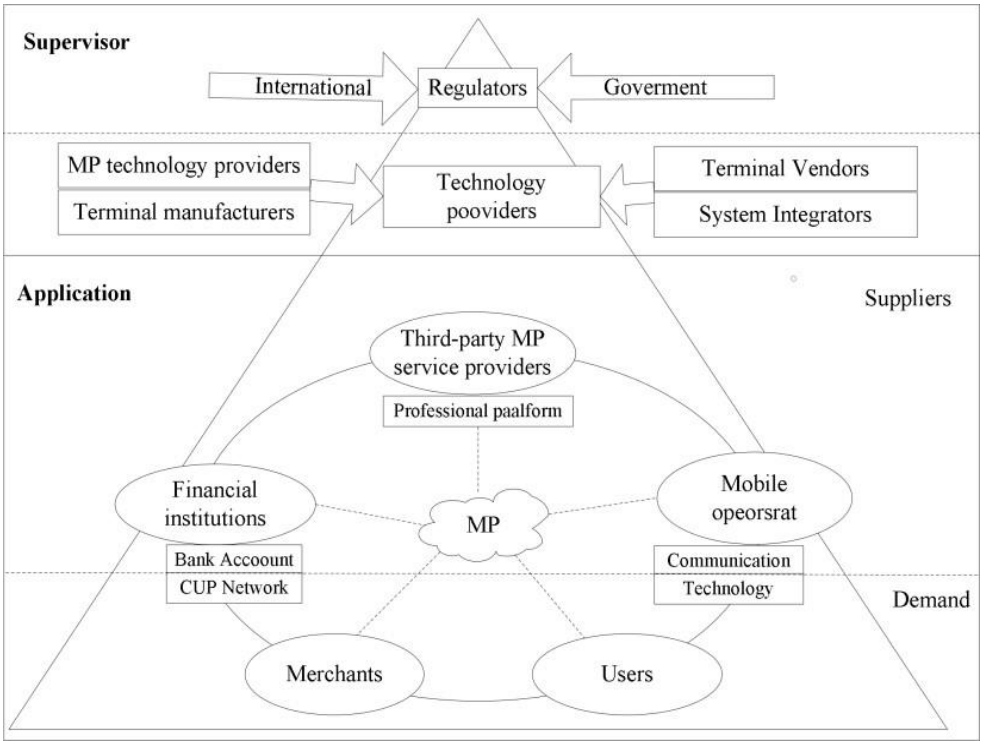

Figure 2-8 Framework of Mobile Payment value network (G. Leo, 2011)

Based on the interaction of these players in the ecosystem it is possible to define various business models; However, four business models are more common to be adopted which will be described in the following.

2.4.1 Operator-centric model

The carrier-based business model is the one in which the customer has either a billing system with their mobile carrier and consequently the amount paid will be aggregated on the customer's bill or has a prepaid balance that is reserved for purchasing products. This business model does not allow macropayments and only carries out micropayments. The reason is lying on the too high default risk due to not conducting any financial background check by the customers. By the way, this model has gained trust as an important advantage because the mobile carrier is the only actor and act as a one-stop-shop (M. Van Bossuyt, 2007).

In this model, the mobile operator puts the mobile payment application on its customers' NFC mobile devices. Either operator supplies a wireless POS system to

the merchant, or operator activates the proximity payment application on the merchant's NFC mobile device.

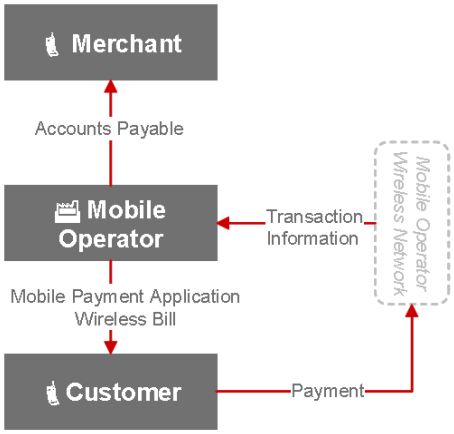

Figure 2-9 Operator-Centric Model: Stakeholder Scenario (Alliance, 2008)

This model confronted several challenges such as risk, privacy, and fraud concerns; utilization of other POS equipment by the merchant; difficulties in billing and customer service; absence of business partnership between operator and merchant. Figure 2-10 summarizes the model value chain.

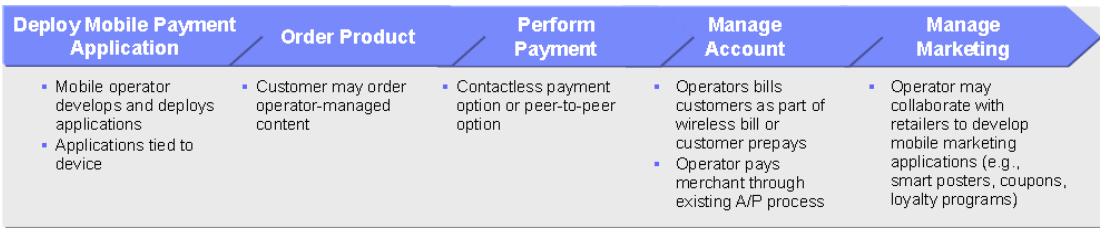

Figure 2-10 Operator-Centric Model: Value Chain (Alliance, 2008)

One of the advantages of this model is establishing the fastest and most convenient approach to get an application on the mobile device because there is not required any commencement of the download by the customer. The main benefit to operators though, is having full control of the revenue stream alongside the brand reputation. Besides, the operator has full authority of the infrastructure and related revenues. In return, there should be taken the responsibility of the risks and liabilities. This model needs an essential rotation in the business of the mobile operator, concentrating on

roles and responsibilities that were not part of its core competencies ever before (Alliance, 2008). Figure 2-11 demonstrate the positioning of the stakeholders respect to risks and benefits.

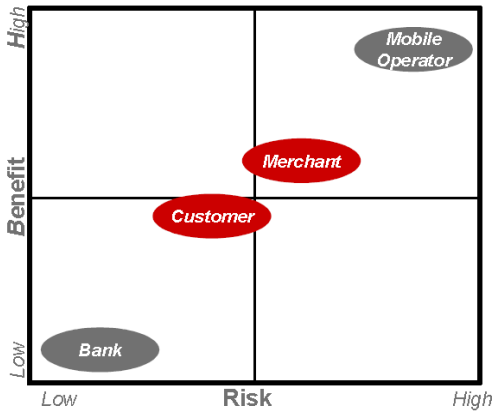

Figure 2-11 Risks & Benefits of Operator-Base Model Stakeholders (Alliance, 2008)

2.4.2 Bank-centric Model

In the bank-centric model, mobile network operators are not engaged in the payment process. Banks are handling payments management through their mobile application. Mobile carriers can only leverage on the SIM-based technologies and thus, get paid by the banks a fee for the mobile network services (F. Asghari et al, 2010).

By doing so, this model expands the existing four-corner model for credit cards into the mobile space. An issuing bank is in contact with the customer and will receive the payment token. Consequently, in the customer's hands, an NFC-enabled phone performs much the same way as currently distributed bank cards. Bank role though may vary between giving its customers a full feature NFC phone and allocation of a payment application to an existing NFC phone. On the other hand, merchants are in contact with acquiring bank which usually supplies them by the point of sales device (Alliance, 2008). Figure 2-12 demonstrates this scenario and relationship between stakeholders.

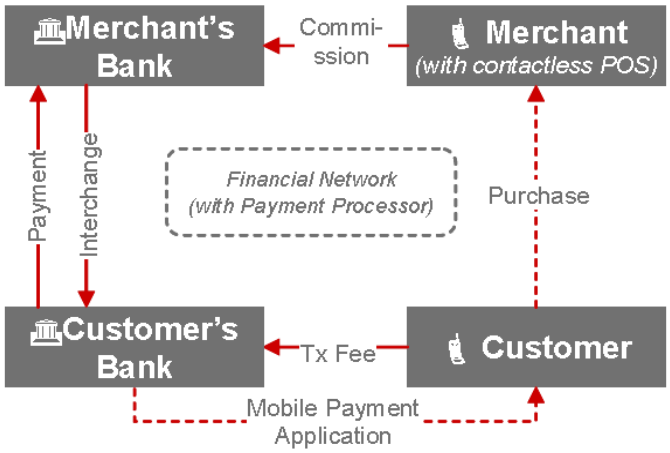

Figure 2-12 Bank-Centric Model: Stakeholder Scenario (Alliance, 2008)

The value chain analysis for each participant is somehow clear. Technology investment brings the issuing bank greater customer loyalty and more direct contact. Transaction times will be faster for a merchant. The acquirer receives electronic transactions and the customer enjoys convenience and flexibility.

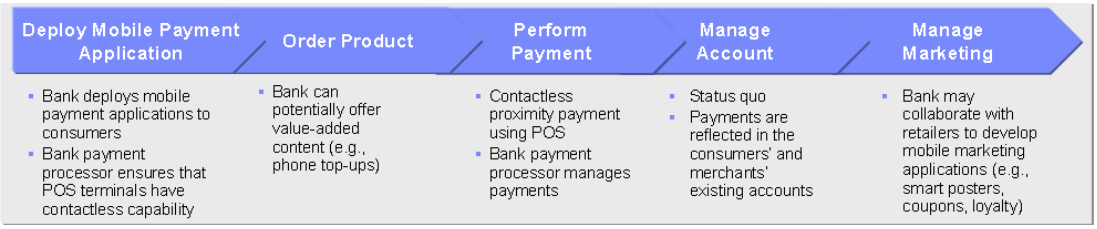

Figure 2-13 Bank-Centric Model: Value Chain (Alliance, 2008)

The main revenue stream for an issuing bank could be gaining from marketing companies brought by the mobile payments' infrastructure. The highest risks though will be for the risk-averse banking sector. Figure 2-14 illustrates the risk-reward profile of this model.

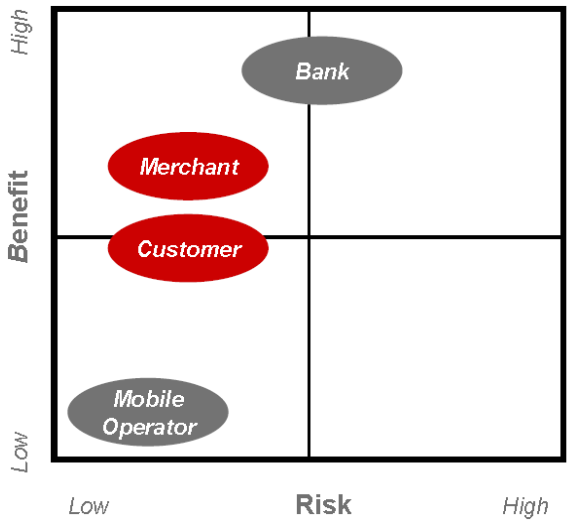

Figure 2-14 Risks & Rewards for Bank-Centric Model Stakeholders (Alliance, 2008)

2.4.3 Peer-to-Peer Model

In this model, the other player's infrastructure including the mobile network for internet connection and the bank account for payment will be utilized to manage the payments (Yunhong Li, 2008). Even though some players are gaining acceptance, the long-term feasibility of model is being constantly challenged by sustainable revenue and inconvenience for POS transactions. This innovative model is created by the new players in the payment industry to identify new processing paths without using existing wire transfer and bank card processing networks. The possibility of p2p money transfer was available through providers like Western Union even for long distances; However; execution of such a service is much more convenient and less costly through the Internet. Another problem resolved by this model is Internet bill payments that could not be handled in real-time before. Some of the implementation strategies of this model are including:

- Establishment of contactless cards/devices to customers and POS equipment to merchants in a closed loop model.
- Supply a mobile payment application for the NFC-enabled mobile device.
- Utilization of an existing online application like PayPal by P2P service provider and no requirement of POS equipment (see figure 2-15).

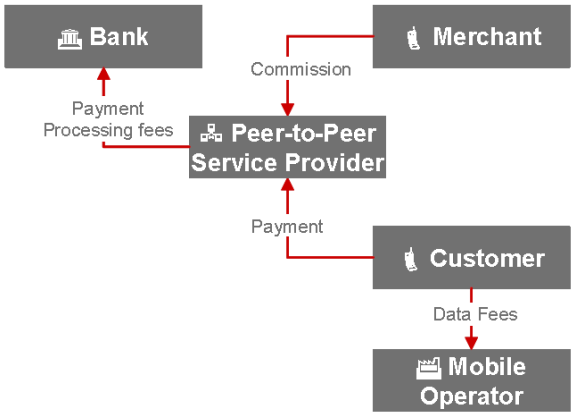

Figure 2-15 Peer-to-Peer Model: Stakeholder Scenario (Alliance, 2008)

This model is remarkably different from the other models in a way that the others try to bring contactless payments the marketplace; However, the P2P Model is going to obliterate the existing payments ecosystem comprised of POS terminals, the ISOs and acquirers, and the processors and payment networks all by utilizing the mobile phone If they succeed in doing so with their technology and achieve wide-spread merchant acceptance of the new form of payment, they could turn the payments industry upside down. Nonetheless, it is more probable that p2p payments will transform to one element in a card issuer's mobile wallet (Alliance, 2008). Figure 2-16 shows the p2p model value chain.

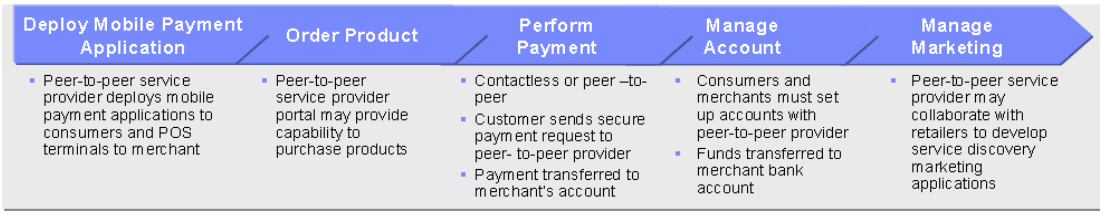

Figure 2-16 Peer-to-Peer Model: Value Chain (Alliance, 2008)

Revenue streams in this model include transaction fees for loading and unloading the account; licensing fees from merchants or end-users for application; customer marketing revenue from merchants and issuers; to exploit stored value account float; and merchant swap. Figure 2-17 shows the risk and reward profile of the p2p model.

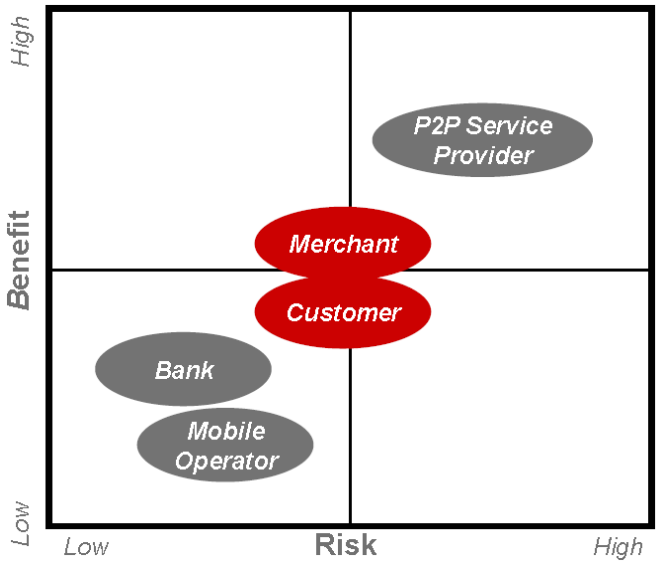

Figure 2-17 Risks and Benefits for P2P Model Stakeholders (Alliance, 2008)

2.4.4 Collaboration Model

The collaboration model entails cooperation among banks, mobile operators and other stakeholders in the value chain, including a trusted third party to manage the utilization of mobile applications. There can be two possible scenarios: A mobile operator collaborates with one bank to provide a bank-specific mobile payments service. Or representatives of mobile operators and financial institutions negotiate to define standards for applications that permit multiple card types from different banks to be employed (Alliance, 2008). Figure 2-18 demonstrates the model scenario.

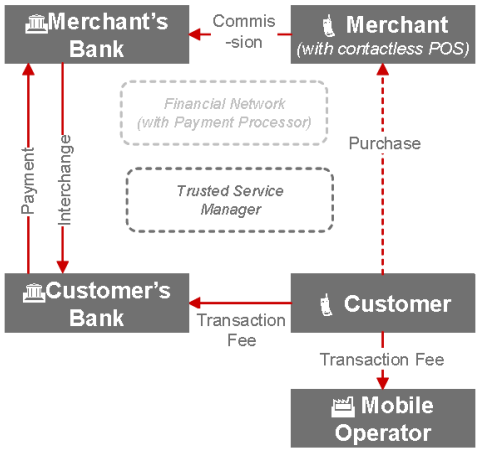

Figure 2-18 Collaboration Model: Stakeholder Scenario (Alliance, 2008)

Potential revenue streams comprise merchant commissions, merchant and consumer transaction fees, new customer acquisition fees, and marketing fees. The essential controversy is how the money will be collected by each stakeholder. Figure 2-19 demonstrates the value chain of the model.

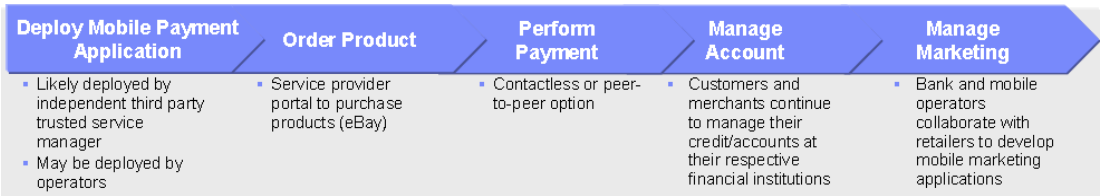

Figure 2-19 Collaboration Model: Value Chain (Alliance, 2008)

It is accepted that the incremental advantages are from additional services that can be created through NFC, such as location-based services, marketing, and NFC-driven innovations. Co-branding and banking alliance could be established profits via regular commercial contracts (Alliance, 2008). Figure 2- 10 illustrates the risk and reward profile. Both banks and mobile operators are confident that the collaboration model will conquer the market; However, it takes time to emanate.

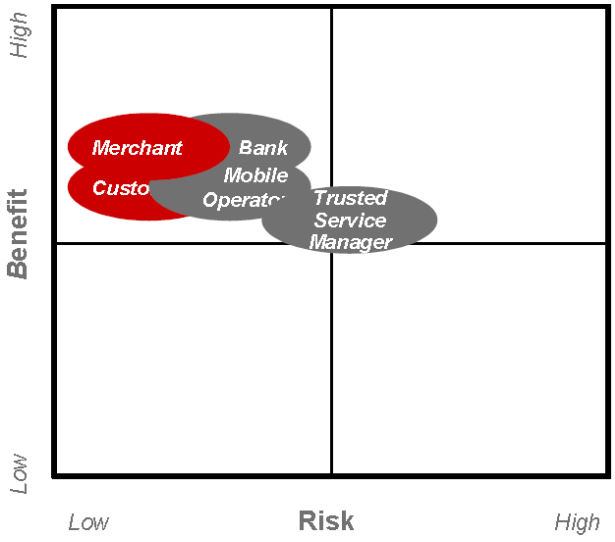

Figure 2-20 Risks & Rewards of Collaboration Model Stakeholders (Alliance, 2008)

There is another mobile business model classification that is suggested Based on both mobile channel characteristics and business model perspective which is shown in figure 2-7.

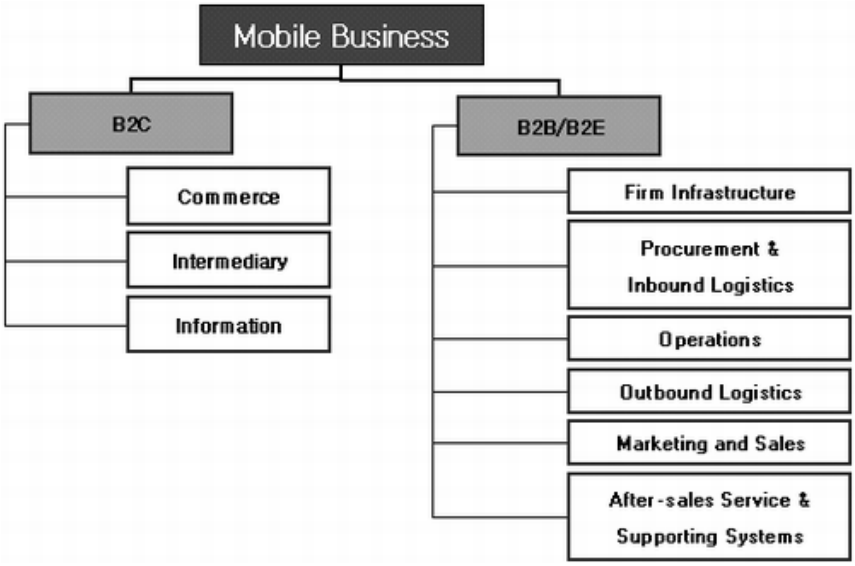

Figure 2-21 Mobile business model classification (C.S. Leem et.al, 2004)

The mobile B2C business model is categorized into three subcategories: A *commerce model* supplies mobile contents and/or services for direct commercial transaction. An *intermediary model* distributes mobile contents and/or services from other sources to customers. An *information model* delivers personalized information to customers' mobile terminals generally on a push basis.

Mobile B2B/B2E models are proposed based on value chain aspects and the landscape of mobile business or mobile solution in a business process. Firm infrastructure denotes a mobile business or solution which supports a firm's general decision making and information sharing, and other categories are based on primary activities of the value chain. (C.S. Leem et.al, 2004)

2.5 Case Studies

In this section, there will be presented a brief summary of the case studies and reports' results from accredited institutions about the mobile payment market.

2.5.1 Federal Reserve Bank Survey

In 2016, the Federal Reserve (FR) Bank of Boston was the leader of the multiple FR Banks for conducting a survey to financial institutions (FIs) about their mobile banking and payment implementations and programs. The results gave consolidated findings in seven FR Districts: Atlanta, Boston, Cleveland, Dallas, Kansas City, Minneapolis, and Richmond. And provided an extensive view of the availability of mobile banking and payment services in the U.S. (Crowe, 2017). In the coming years, more consumers and businesses continue to leverage mobile payment channels for financial services through Financial Institutions alongside nonbank processors, technology companies, and merchants because as new use cases emerge consumer eagerness for the mobile/digital channels will increase.

Regarding the development issue, most respondents consider their strategies for mobile payments and would like to offer these services. In response to the question "Do you offer or plan to offer mobile payment/wallet services to customers?" Twenty-four percent of FI respondents offer mobile payment services (Figure 2-8). Another 40% of respondents forecast offering mobile payment services within the next two years, bringing the percentage that offers mobile payments to 64% by 2018. At the time the survey was conducted, 36% of respondents did not plan to offer mobile payments.

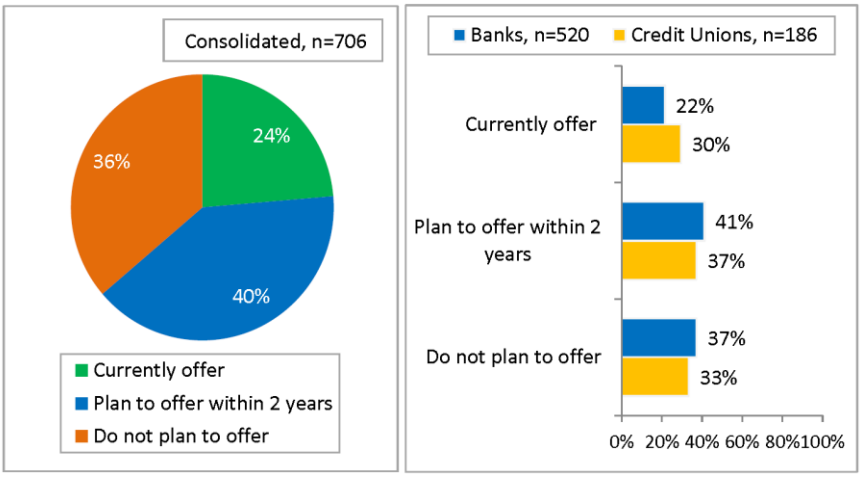

Figure 2-22 FI plans to Offer Mobile Payment Services (Crowe, 2017)

Mobile Payment Strategies

67% of respondents answers to the question "Please rate the importance of factors that influenced your FI's decision or plans to offer mobile payments." considered competition with other FIs as the essential driver in offering mobile payments, more so than competition with nonbanks like Amazon, Apple, Google, and PayPal, which received high ratings from 50% of the group (Figure 2-9). Just behind the competition with other FIs, 60% evaluated mobile payments momentum with high significance. Respondents gave the most medium ratings to mobile device security and customer demand. Using incentives to foster customer engagement; generating revenue reducing cost and providing a two-way mobile communication tool were all rated as insignificant enablers in view of more than 40% of respondents.

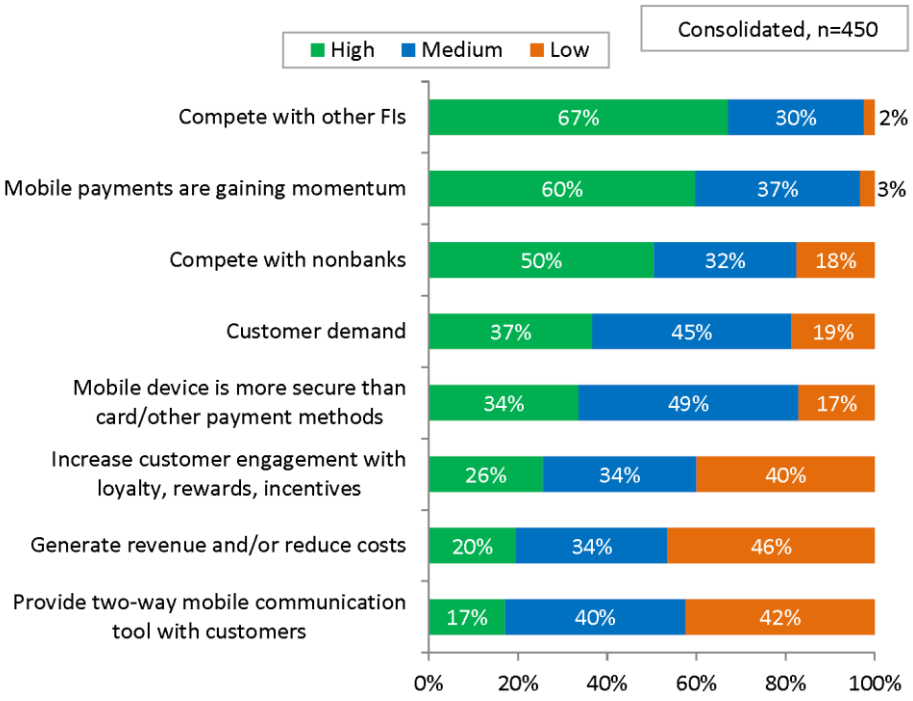

Figure 2-23 Drivers for Offering Mobile Payment Services (Crowe, 2017)

In response to the question "How do you offer or plan to offer mobile payment/wallet services?", 'partnering with third-party payment processors' and 'partnering with NFC wallet providers' are considered the two most important strategies for offering mobile payments (Figure 2-10). 67% specified a preference for third-party

processors; 53% planned to use NFC wallet providers. Banks and credit unions weighed these strategies differently. On the one hand, more banks partner with third-party processors. On the other hand, credit unions that preferred partnerships with NFC-enabled wallet providers were more than banks.

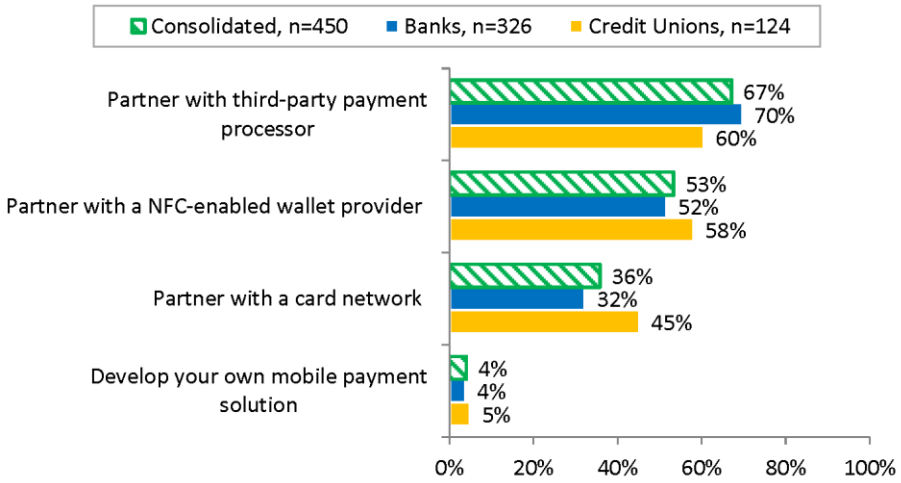

Figure 2-24 Strategies for offering Mobile Payment (Crowe, 2017)

Mobile Wallet

The participants of the questionnaire were asked "Please indicate the mobile wallet service(s) that you are familiar with" for measuring the familiarity with different mobile wallet services. most respondents were aware of the three NFC "Pay" wallets including Apple Pay, Android Pay, and Samsung Pay. Nearly three-quarters of the group were also familiar with PayPal's mobile wallet. Respondents had some familiarity with the digital wallets offered by the card networks such as Visa Checkout and Masterpass.

Table 2-7 FI Mobile Wallet Recognition (Crowe, 2017)

Wallet	% of Respondents (n=450)
Apple Pay	98%
Android Pay	82%
Samsung Pay	77%
PayPal	74%

Visa Checkout	45%
Amazon Payments	41%
Mastercard Masterpass	37%
Walmart Pay	29%
Microsoft Wallet	21%
Amex express checkout	10%
LevelUp	8%
Other	3%

They were also asked, "Which of the following MOBILE WALLET service(s) do you offer or plan to offer?". The results showed that most FIs offered or planned to offer one or more of the NFC "Pay" wallets. Support for Microsoft Wallet has been limited because the wallet is somehow new (launched in June 2016).

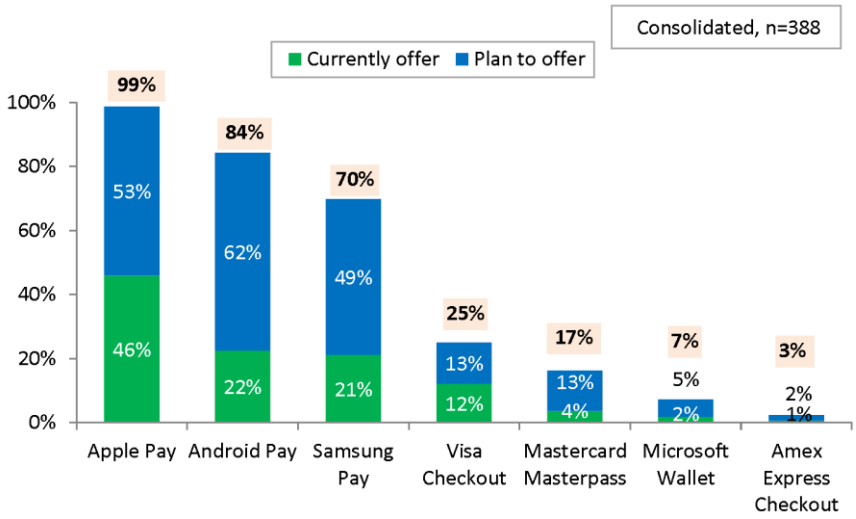

Figure 2-25 Mobile Wallets Offered by FIs (Crowe, 2017)

Consumer Adoption of Mobile Payment Services

Regarding customer adoption, some of the respondents that offer mobile payments, track customer registration data, and others track customer usage of mobile payments. Considering some of the challenges associated with security and merchant acceptance, customer enrollment is growing at a slow rate. Majority of FI

respondents had less than five percent of their customers registered and actively using their mobile payment services.

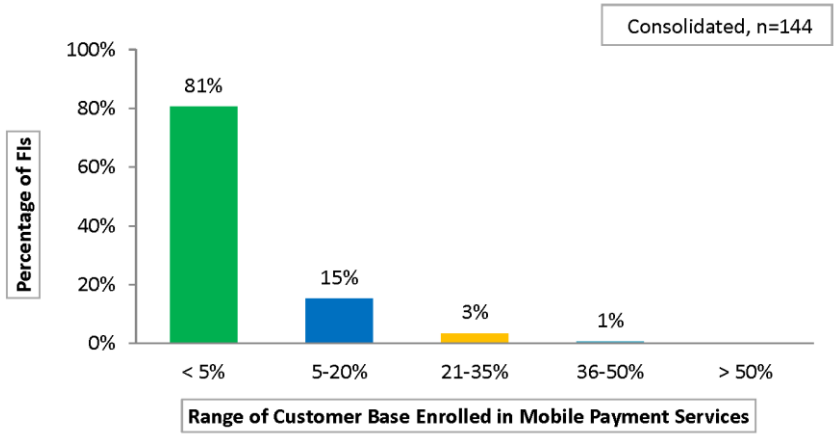

Figure 2-26 Customer Enrolment in Mobile Payment Service (Crowe, 2017)

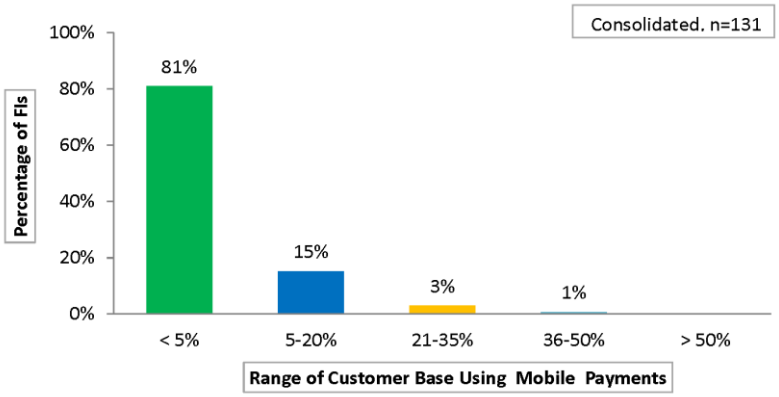

Figure 2-27 Customer Use of Mobile Payment Services (Crowe, 2017)

Mobile Payment Security

Following the utilized approaches for mobile banking, FIs also employ a layered approach to improve mobile payments security. It should be noted that all security tools are not common for mobile wallet services. For instance, because NFC "Pay" wallets store tokenized payment credentials in the mobile phone and allow customers to use a fingerprint to authenticate, FIs that implement NFC "Pay" wallets support both biometrics and payment tokenization. Results show that the two most commonly supported security tools were biometrics and payment tokenization. Detailed findings are shown in figure 2-14 by the percentage.

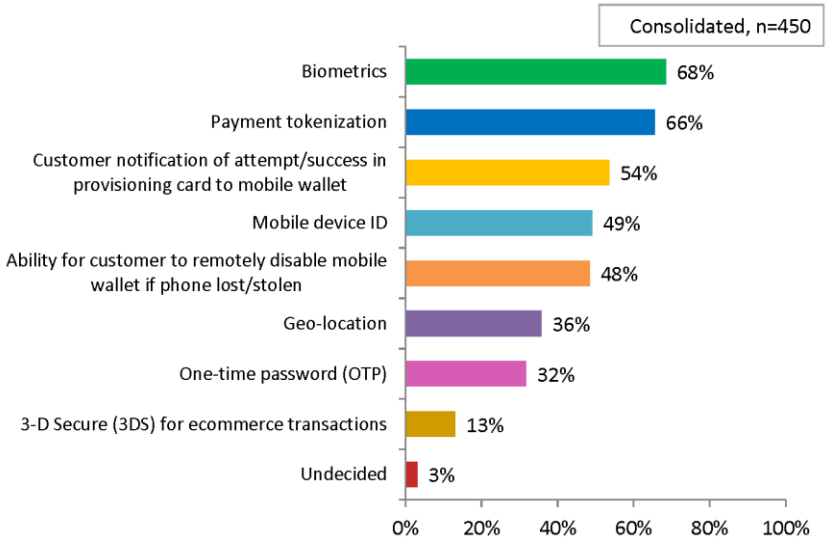

Figure 2-28 Security Tools Used for Mobile Payments (Crowe, 2017)

2.5.2 Unlocking the Value in the Mobile Payment Ecosystem

In this section, it will be briefly summarized the notion of extracting values in the mobile payment ecosystem mostly done in the U.S. by Deloitte company (Deloitte, 2011).

Regulatory intervention in the east

the telecom sector in the United States is highly competitive and unlike Japan, there is no single carrier that has enough market power to apply a harmonized mobile payments solution for the whole value chain. Similarly, Singapore's highly competitive telecom sector in the time of building a standard ecosystem for mobile payment faced familiar challenges. Mobile operators in Singapore tried several times to offer competing but incompatible contactless standards for mobile payments, therefore the Singapore regulatory and policymaking body, the InfoComm Development Authority (IDA), interfered the market.

The IDA evaluated that an interoperable NFC ambient would build a market size that would be eight times bigger than that of a non-interoperable environment (IDA, 2009). It started two big initiatives in 2009. First, it instituted a private organization

comprising of members from the public and private sector to develop a standard ecosystem for mobile payments. Second, it invested in the establishment of a point of sale (POS) readers for payments based on Near Field Communication (NFC). (IDA, 2009)

Mobile operators and financial institutions in Singapore cooperated on an interoperable deployment of NFC mobile payments using a Trusted Third Party (TTP) infrastructure. The TTP played a role as a neutral party that provides interoperability by delivering a single point of contact for all banks, payment providers, and mobile operators.

In China, the Ministry of Information Technology and industry tried to deploy a common payment platform for China Mobile and China Unicom. Policymakers are weighing the option of going with a proprietary system (China Mobile) versus adopting NFC (China Unicom). (News, 2010)

In India, the government is establishing a common, interoperable mobile payment infrastructure that includes a switch to ease transaction routing between financial institutions and mobile operators (Inter-Ministerial Group, 2010).

The Federal Reserve Bank of Boston, one of twelve regional banks in the Federal Reserve System, clearly stated that there is no need for the Federal Reserve or any government organization to take the lead in establishing common standards for mobile payments in the United States (Crowe, 2010). They suggested that the market should be allowed to develop open or proprietary standards.

Thus, it seems improbable that regulatory bodies in the United States take the lead in building a standardized payment infrastructure or establishing cooperation among mobile operators and financial institutions. For successful mobile payments in the United States, it is necessary that crucial players in the value chain cooperate voluntarily to minimize redundancy and build a harmonized platform to encourage merchant and consumer adoption.

Barriers in the United States to mobile payments

According to the survey conducted by Deloitte, the key players face four important barriers including lack of consumer knowledge, shortage of demand, competing

platforms in a fragmented market, and the lack of revenue-sharing agreements between critical players in the value chain. If the industry can smooth disagreements on revenue sharing, then the establishment of a common technology platform, addressing a lack of consumer knowledge and demand are much easier to cope with.

Financial institutions and mobile operators in the United States have effectively communicated the value proposition of mobile banking in the last years, which resulted in fast adoption of this service. Similarly, when the biggest players provide mobile payment solutions extensively, it is probable that they will put their marketing power on a sustained information campaign to educate consumers about the advantages of mobile-based payments.

Consumer demand is strongly linked to effective consumer education and the ubiquitous availability of mobile payment services at retail outlets. The mobile payment solutions in the United States are mostly of niche services in specific geographic markets in the current situation. Services like P2P and merchant loyalty programs are provided on the mobile device by payment providers, eliminating financial institutions and mobile operators. The lack of engagement in mobile retail payment from financial institutions and mobile operators overlaps with a lack of readiness (See figure 2-15) Indications obtained from the survey show that most of the critical players are yet in the planning phases of mobile payment deployment (Deloitte, 2011).

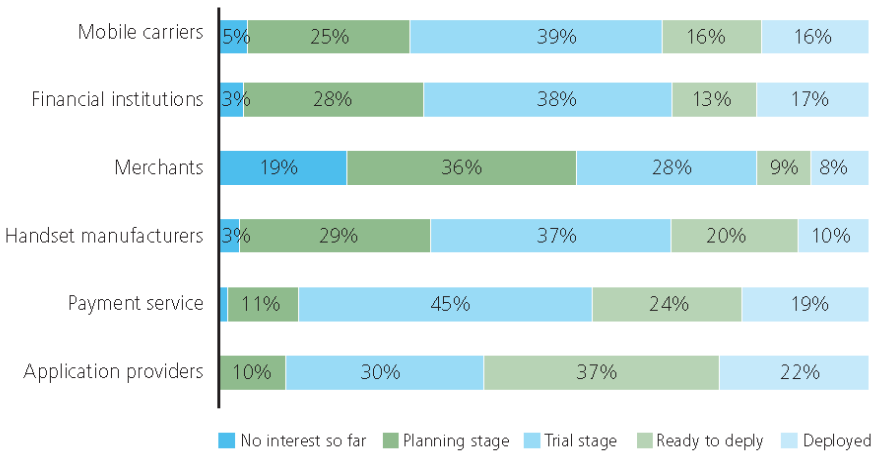

Figure 2-29 Preparedness of key players to deploy mobile payments (Deloitte, 2011)

Mobile Payments Freedom

For the liberation of mobile payments in the United States will be necessary to align the contrasting interests of heterogeneous industries by providing mutually beneficial business and revenue models and adopting a standardized technology platform that realizes scaling and targeting merchants who benefit most from mobile payment. Regarding the selection of a Revenue Model, the survey results show that non-cooperative and fragmented efforts between critical players yield mobile payment services that fail to release the full potential of the mobile platform.

To deploy mobile devices associated with virtual credit and debit cards to pay for retail payments would be indispensable a unanimity about how to partner and share revenues. The most achievable business models, according to the survey, are partnerships between mobile operators and financial institutions and the open federation model as demonstrated in figure 2-16.

In an open federation model, players like mobile operators, financial institutions, merchants and others will be gathered together to deliver multiple payment services on a common platform across different devices (D. Goswami, 2009). To move to an open federation model it is crucial to take intermediate steps. Mobile-financial institution partnerships can be considered as an intermediate step toward a more open and harmonized mobile payments ecosystem.

For mobile operators and financial institutions, “one-to-one” partnerships are simpler to achieve and may be the first step toward a feasible and trusting relationship. The financial institutions though have been reluctant to divide their revenue pie thinner by sharing their merchant revenues with mobile operators. There is good support to increase the revenue with innovative services that will convince financial institutions to cooperate including location-aware services, e-coupons, and mobile advertising, which has been approximated to be a $24 billion market in 2015 (Deloitte, 2011).

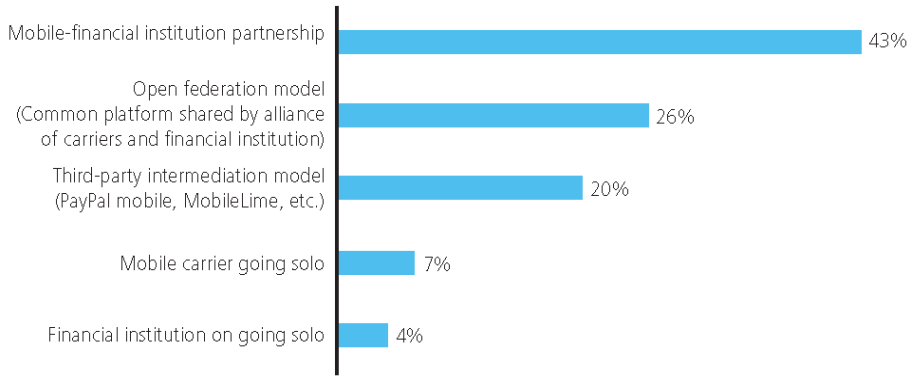

Figure 2-30 Most viable business models (Deloitte, 2011)

2.5.3 Mobile Payments Global Growth and Forecast

In this section, some numbers and projections about the regional and global usage of mobile payments will be presented.

According to McKinsey, Although the overall number of transactions in the world is increasing, the key revenue driver is the digitalization of the transactions (figure 2-17) (McKinsey&Company, 2018). Over the past five years, the share of the world's transactions executed in cash has fallen more than ten percent, and this reduction of cash usage globally is foreseen to be even more noticeable over the next five years, because of an increasing range of payments options, the push toward real-time payments, the growth of digital commerce, and continued regulatory focus on payments electronification. For instance, the share of electronification in China has increased more than ten-fold over the last five years, from 4 percent in 2012 to 34 percent in 2017.

There are some interesting points about the figure 2-31. On the one hand, North America has become the first region to carry out more than half of its transactions electronically and has 450 e-transactions annually per capita. On the other hand, leading European countries such as Sweden and Norway are conducting no more than 20 percent of their transactions in cash, while generating 520 noncash transactions per capita per year.

There will be a big shift in digital payments trend. Because of the increasing popularity of alternative payments solutions, and in general digital commerce. Global digital commerce volume (defined as all consumer remote POS transactions via

online or mobile channels, like retail e-commerce, but excluding in-store digital wallets.) surpassed $3 trillion in 2017 and will be expected more than double by 2022.

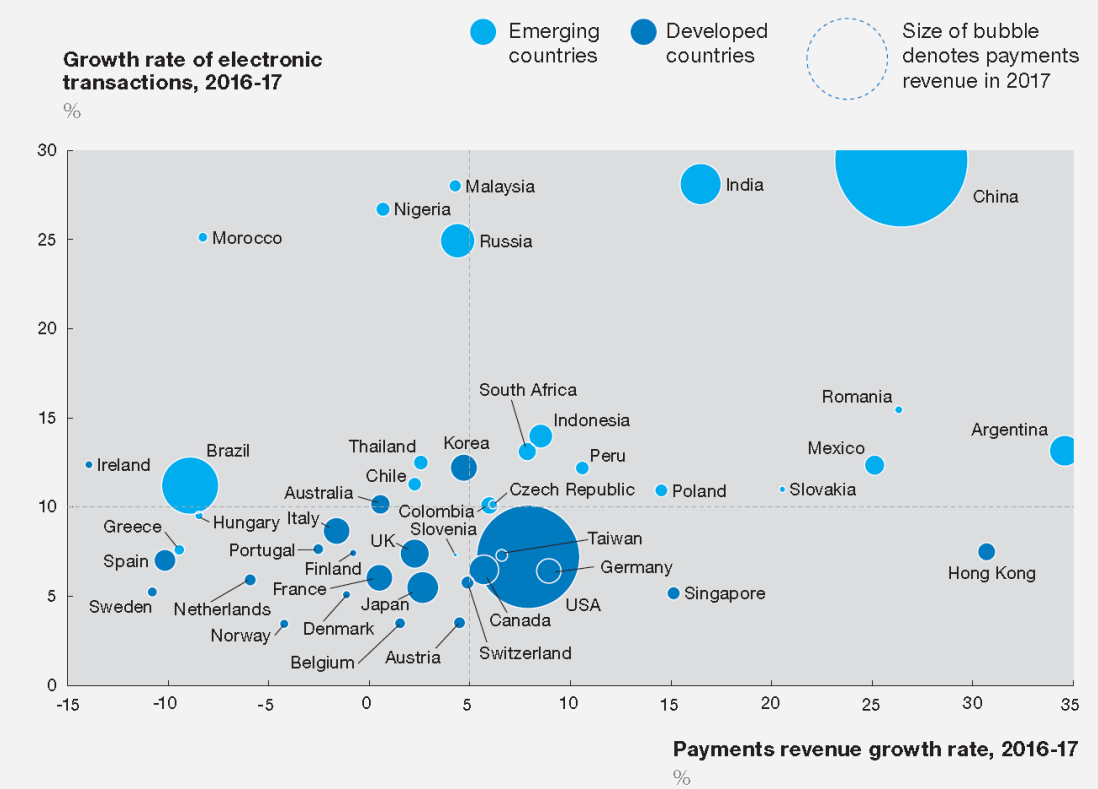

Figure 2-31 Positioning Map (McKinsey&Company, 2018)

Asia-Pacific contains already over half of this volume and, will expand its share to nearly 70 percent by 2022 due to the booming Chinese market. Mobile commerce, including in-app and mobile browser payments, is the paramount driving factor of digital commerce growth. Mobile commerce will include 48 percent of digital commerce sales globally as of 2017 and is approximated to arrive at 70 percent by 2022 (tripling to $4.6 trillion). (McKinsey&Company, 2018)

The witness to that is the embracement of app-based commerce and in-app payments by both Consumers and merchants, and huge investments of retailers in mobile apps with innovative use cases to establish omnichannel shopping experiences for customers. From the global point of view, mobile apps comprised more than 30 percent of total digital commerce volume in 2017 and are estimated to continue

strong growth across all regions (figure 2-18). Digital wallets are expected to have added approximately 40 billion to global payments revenues in 2017.

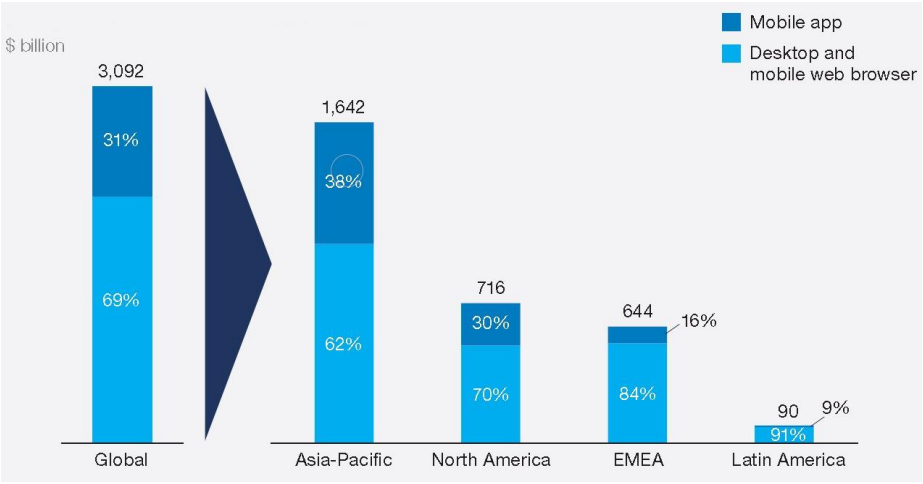

Figure 2-32 Global digital commerce breakdown 2017 (McKinsey&Company, 2018)

The landscape of in-store commerce differs remarkably by country and region. In countries with NFC infrastructure, tap-and-pay will boost growth; in the United States though, as consumer use of order-ahead rises in-store app usage will expand; and in emerging markets, the emergence of new payments solutions will affect the way in which people pay.

Usage of digital wallets in the US, per person, will grow at a 45 percent CAGR to arrive nearly $400 billion in annual flows by 2022. Even though most of this growth is estimated to be on “pass-thru” wallets like Apple Pay, but private-label wallets such as Starbucks and Walmart Pay also continue to raise their popularity. However, with these gains yet, digital wallets will contain less than 10 percent of US consumer in-person POS payments in 2022. Lack of unanimous merchant acceptance will be a barrier, along with the continued percentage of consumers who lack the knowledge to pay at the point of sale.

In the UK, a total of 38 million contactless transactions were carried out by a mobile device in 2016 which equals roughly $358 million in spending. Although this is big in absolute value, it comprises only 1.2 percent of in-store payments, proving a huge opportunity for growth.

China is the leader with 40 percent of in-person spending already on mobile digital wallets. However, almost all of this is on closed-loop systems like WeChat Pay and Alipay. China's ratio is approximated to continue to rise to nearly 60 percent by 2022. (McKinsey&Company, 2018)

Mobile Payments in Italy

The new digital payments in Italy arrived at €80 billion which shows more than 50 percent growth respect to 2017. The forecasts say that it will surpass €125 million by 2021. This number represents 33 percent of the card payments and 12 percent of the whole Italian payments.

The key driver for this growth is particularly the proximity component with 100 percent increase including Mobile Proximity Payment, Contactless, and Mobile POS which altogether comprise €49 billion. The remote payment component though, including eCommerce, ePayment, Mobile remote commerce, and Mobile remote payment, has experienced 15 percent growth to arrive at €31 billion.

Other interesting numbers are about Mobile remote commerce and payments. The former has passed €8.4 billion which means more than 40 percent growth respect to the previous year and equals to 31 percent of total eCommerce transactions. It is approximated to arrive almost €20 billion in 2021.

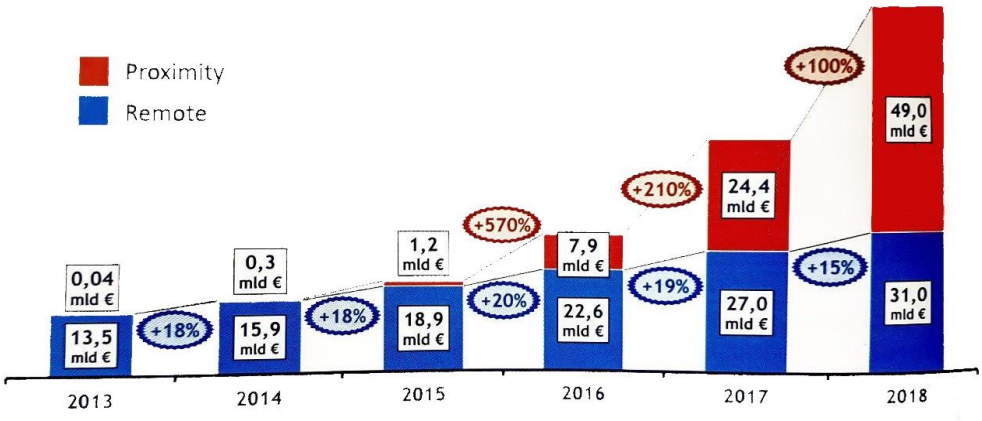

Figure 2-33 Digital payments in Italy: Remote vs Proximity (Oss.M-Payment, 2019)

The latter though, by arriving at almost €900 million that is more than 10 percent growth, confirmed that it has reached the maturity in the majority of its components. Deriving the mobility sector which values more than €180 million, it is estimated to arrive at €1.5 billion in 2021. (Oss.MobilePayment, 2019)

2.6 Startup Ecosystems

The word "Startup" has been addressed extensively in the literature. From the various definitions to different characteristics of a startup, which are out of the scope of this report. In this section, there will be presented a brief summary of the description of the startup ecosystem, its components and how the relationship among different components can change and will affect the whole ecosystem.

In the mobile payments, market startups take the role of trusted third-party platform providers. By benefiting infrastructures of the banks and mobile carriers, they make different and various solutions available to the consumers; However, for analyzing future trends of mobile payments, identifying the impacting factors on startups is essential. This specifically leads to the detection of the factors that affect the most on mobile payments.

It should be noted that the startup ecosystem is referred to entrepreneurial and entrepreneurship ecosystem. The entrepreneurial ecosystem has been approached and analyzed from different perspectives such as strategies, narratives' impacts, and open innovation.

In an extensive study, Isenberg has analyzed strategies for the entrepreneurial ecosystem. But at the core of the entrepreneurship ecosystem strategy, obviously, should be the consideration of what factors comprise the entrepreneurship ecosystem. Noticing of societies in which entrepreneurship takes place with any regularity or self-sustain, is the observation of a unique, complex developed ecosystem which brings to existence the necessity of having a strategy (Isenberg, 2011).

Six main domains were identified to influence entrepreneurship. The relationships between the domains were not identified; however, they provide a view on the entrepreneurs' outlook on the environment surrounding them that affects both their

decision making and success. So, for them to be self-sustaining entrepreneurship, it is required favorable policy, markets, capital, human skills, culture, and supports (Isenberg, 2011). Each of these domains has subsets and more detailed factors that have been presented in detail in one of the previous reports (Zayed, 2017). A brief summary of each factor is presented in the following.

Policy

The policy has been divided into two parts: Leadership; and Governance. In the leadership there exist some items like Unequivocal support, Social legitimacy, Entrepreneurship strategy, etc. while in the governance part there are issues like Institutions, Financial support, Regulatory framework incentives, etc.

To analyze the global trend of entrepreneurial protecting policies Norback studied entrepreneurial policy in the form of entry expenses in a lobbying model considering the conflict of interest between entrepreneurs and incumbents. They have demonstrated the more international market integrate the more pro-entrepreneurial policies will generate. The protecting policies will result in making domestic incumbents protection difficult and making foreign entrepreneurs less aggressive. According to their findings and coherent with the theories, *international openness* is negatively correlated with entry barriers for new entrepreneurs (P.J. Norback et.al, 2014).

The impacts of *tax policy* on venture capital activity have been studied by (C. Keuschnigg, 2003). Most of the time, entrepreneurs have no own resources. Thus, financiers supply funds for investment cost plus an extra payment, in return for a share in the firm. They established a general equilibrium framework and explored the impacts of taxes on the equilibrium level of managerial advice, entrepreneurship, and welfare. Several tax policies like differential wage and capital income taxes, a comprehensive income tax, progressive taxation have been investigated.

In an empirical research, the analysis of data proved that lower levels of labor frictions and higher levels of Small Business Innovation Research awards are directly related with more business starts and a higher number of venture capital per capita.

They investigated various policy tools and compared how the *labor policy* may affect in regular times with the financial crisis of 2008–2010 (D. Cumming, 2013).
The innovation *financing policies* for entrepreneurial development in East Asia have been studied in a research (J. Wonglimpiyarat, 2013). specifically, they concentrated on the applications on the venture capital and capital market funding policies. It is demonstrated that the government intervention model has been successful in Singapore and Taiwan. The reason for this success may have found in clear agencies responsible for handling policy implementation. They proposed empirical reasons on establishing innovation financing policies for national economic development.

Markets

Markets are also comprising two categories. On the one hand, there are early customers including early adopters, reference customer, distribution channels, etc. On the other hand, there are Networks including entrepreneurs' network, diaspora networks, and multinational corporations.
In one of the recent papers, it is discussed that the diversity level of entrepreneurial strategic networks varies upon the nature of the entrepreneurial opportunity context that is discovery or creation. In other words, entrepreneurs working in 'discovery' contexts have a tendency to benefit networks ties with individuals who are somehow like themselves, but entrepreneurs in 'creation' contexts are willing to use network ties with individuals who are somewhat different from themselves (J.W. Upson et.al, 2017).

Financial capital

It is including Micro-loans, Angel investors, venture capitals, Private equity, etc. At late stages of the startup financing to scale the business two forms of financing provide the largest amounts of investments to entrepreneurs, that is banks and venture capital. Each of them has its own advantages. Bank loans permit the entrepreneurs to keep the full control and shares of their business, which may be an incentive for entrepreneurs to put more time and effort into the business to achieve success. On the other hand, venture capital may give the accessibility to a perspective

that entrepreneurs will not find in the banks, that is managerial advice, and the price of that is equity. VC's investments are focused in industries where they have essential knowledge and expertise so they can offer management advice. VC investment has also the advantage to Entrepreneurs from the VCs contribution to the startup. (J. De. Bettignies, 2007)

Human skills

Human capital is composed of labors that are skilled or unskilled, serial entrepreneurs, later generation family. Educational Institutions though have inside general degrees or specific entrepreneurship courses.

Entrepreneurship role is growing in employment opportunities and providing the solution to the unemployment issue. Educational institutions' role in entrepreneurship education is also significant. Educational institutions have demonstrated their impacts on entrepreneurship, by training, teaching and encouraging students and recent graduates about entrepreneurship (E. S. Başçı, 2015). Some entrepreneurial skills can make the difference between a good idea and a successful startup. The required preparations needed in the venturing process are necessary to be done. Including problem solving, pitching the business, recognizing business opportunities, defining a long-term strategy and goal, risk assessments, and identifying both the mission and the vision of the company along with many other personal traits; notwithstanding general education cannot provide these set of skills, they will be gained through the entrepreneurship experience (S. Estrin et.al, 2016).

Culture

Culture is divided into Success stories like visible successes, wealth generation for founders, and international reputation. The other part of the culture is Societal norms such as risk tolerance, innovation and creativity, social status, and ambitions.

One of the most extensive studies on culture research is Hofstede's five cultural dimensions which consist of *Power Distance, Uncertainty Avoidance, Individualism vs. Collectivism, Masculinity vs. Femininity, and Long-term vs. Short-term Orientation* (G. Hofstede, 1984)

It should be noted that Hofstede's indices are representing the average of a culture, and therefore must not be applied in a general sense. Some researchers have investigated a relationship between Hofstede's culture dimensions and entrepreneurship and innovation. The studies have generated some conflicting results. Generally speaking, evidence confirm that culture characteristics affect national levels of entrepreneurship, but not necessarily consistent over time (J.C. Hayton et.al, 2002).

Supports

Support may be the most important factor and comprised of three different parts including Infrastructure that is telecommunications, transportations, energy, and zones; Support professions that are legal, accounting, investment bankers, technical advisory; and Non-governmental institutions that are business plan contest, conferences and entrepreneur-friendly associations. Incubators can provide various services to entrepreneurs such as innovation support, providing infrastructure, and business development in their local market. Technological centers help integrating new technological developments and establish testing labs to make sure the quality of products and raw materials to be as competitive as possible. Infrastructures are not directly linked to the expansion of the business, nevertheless combining the infrastructure affects essentially on the growth of young innovative (N. Roig-Tierno et.al, 2015).

International NGOs can strongly affect entrepreneurship, but their impact does not come in a direct form. That means, their effects will be directed through governmental regulations, allocation of funding, and through R&D. They usually influence public opinion to impose their power. Factors influenced by NGOs are regulation and institutional funding which both are also sought by entrepreneurs to find the appealing product. Nonetheless, the impacts in funding, regulation, and research caused by NGOs are mostly beneficial for the general well-being and the environment, they are brought at the cost of wealth destruction (Auplat, 2006)

2.6.1 Startup Ecosystem Definition

Although the entrepreneurial ecosystem literature has gained attention, especially in policy topic; However, the literature lacks some issues including (1) a clear analytical framework that shed light on the cause and effect in an entrepreneurial ecosystem; (2) the entrepreneurial ecosystem has not yet fully leveraged on network theory, though it is a systemic concept, and it is unclear how the proposed elements interact in an entrepreneurial ecosystem; (3) how the structure and performance of entrepreneurial ecosystem will be affected and by which institutions is still an issue; (4) research works usually is done based on single regions or clusters on the entrepreneurial ecosystem, missing a comparative and multi-scalar perspective; (5) the literature usually gives a static framework without considering systematically the evolution of entrepreneurial ecosystem over time. (J. Alvedalen, 2017)

One definition of an entrepreneurial ecosystem, based on a synthesis of definitions found in the literature, can be expressed as follows:

> *"a set of interconnected entrepreneurial actors (both potential and existing), entrepreneurial organisations (e.g. firms, venture capitalists, business angels, banks), institutions (universities, public sector agencies, financial bodies) and entrepreneurial processes (e.g. the business birth rate, numbers of high growth firms, levels of 'blockbuster entrepreneurship', number of serial entrepreneurs, degree of sell-out mentality within firms and levels of entrepreneurial ambition) which formally and informally coalesce to connect, mediate and govern the performance within the local entrepreneurial environment"* (C. Mason, 2014)

Entrepreneurial ecosystems usually come to existence in locations that have place-specific assets. For instance, Oxford has been exposed as an entrepreneurial ecosystem due to its strategic location with respect to London and Heathrow airport, its attractiveness as a place in which to live, its university and associated global brand and its unique cluster of UK government laboratories (H. L. Smith, 2013).

2.6.2 Metrics for Entrepreneurial Ecosystems

It is necessary for policy-makers to understand entrepreneurial ecosystems in order to interfere effectively. To satisfy this requirement entrepreneurial ecosystems should be measured (Vogel, 2013b). If the effectiveness of the various components in an ecosystem, as well as the whole ecosystem, cannot be evaluated, there will not be the possibility of improving programmes and establish complementary sources (P. Vogel, 2013a). Metrics help to identify the strengths and weaknesses of individual ecosystems, which leads to having a clear idea of its special qualities or deficiencies and the power of the ecosystem. From an external point of view, the evaluation of individual entrepreneurial ecosystems gives them the possibility to be benchmarked against other ecosystems, both in the same country and in other countries. Thus, highlighting the underdeveloped aspects of individual entrepreneurial ecosystems (C. Mason, 2014). Vogel has used a variety of secondary sources to create an entrepreneurial ecosystem index based on three levels: individual, organization, and community (table 2-8) (P. Vogel, 2013a)

Table 2-8 An ecosystem index (P. Vogel, 2013a)

Scale	Measures
Individual	ˬ Culture Index ˬ Personal wealth index ˬ Work and life satisfaction index
Organisation	ˬ Organisational performance
Community	ˬ Policy index ˬ Market index ˬ Location index ˬ Job creation index ˬ Infrastructure index ˬ Visibility index ˬ Support index ˬ Network index ˬ Talent index ˬ Funding index ˬ Education index ˬ Innovation index ˬ New venture index

CHAPTER 3
METHODOLOGY

In this chapter, the methodology used for doing the census about mobile payment startups will be explained. Then the path to arrive the final result (dataset) will be demonstrated.

3.1 Methodology

The starting point and the primary source of the information is the Crunchbase website. CrunchBase is a platform for finding business information about private and public companies. CrunchBase information include investments and funding information, founding members and individuals in leadership positions, mergers and acquisitions, news, and industry trends (Wikipedia, n.d.).

The data provided by Crunchbase, in fact, range from general information such as birth year start-up, description of the concept, website, the name, and the surname of the founders; up to the amount of funding received by the startup from its birth until today.

It should be noted that CrunchBase is a kind of Wikipedia like a database. It means that the information uploaded on this database are added by the startup owners themselves rather than by investors. Therefore, it is always recommended to integrate what is collected from Crunchbase with other sources.

3.1.1 Procedure and Boundaries

In this section, the process of the boundary determination will be explained. That is, what is the perimeter of the study and scope of the research. For defining the very first boundaries of the research, the "Crunchbase Pro" features are utilized to narrow down the target startups. Including the bindings about the founding date, last funding date, operating status, and operating categories.

Founding date

Founding date limit was set to the last day of the year 2013 that is 12-31-2013. By doing so, all the startups that are founded in the last 5 years will be included in the examination area.

Operating status

Operating status has been set to "Active". That is, the startup is alive and is not closed, neither has done an exit nor acquired.

Last funding date

Last funding date was set to the last day of the year 2016 that is 12-31-2016. By doing so, all the startups that were funded at least once in the last two years will be considered.

By setting these boundaries, the Perimeter of the research zone is defined; However, this is a multidimensional data set and it is needed to set enough boundaries in all the directions and dimensions. Therefore, the next step is to define the desired categories of interest which should be searched.

3.1.2 Application Areas

In the field of Mobile Payment, historically, there have been six pre-defined areas of application for the primary function of the startups which include the following

- ***Mobile Commerce***: This category basically includes the e-commerce transactions which are done through handheld devices like cell phones or Tablets. That is, execution of commercial transactions online such as purchase or sales of the goods and services.
- ***Mobile Wallet***: Including the applications which provide the payments, or the realization of the services associated with the purchase process such as Mobile Loyalty or Mobile Couponing. These services enable the merchants to extend their channels towards business development.
- ***Bitcoin***: Includes all the services based on the blockchain technology that uses cryptocurrencies instead of real money to do mobile transactions online. The utilization of the blockchain technology in theses service can provide the customers more secure and more innovative solutions.
- ***Payment Acceptance***: Providing the ability to pay in the mobility and having accessed to real-time data and credentials of the customer, these services realize the process of making the customer close to the cash desk, by means of revolutionizing the payment experience in the store.
- ***Technological Solutions***: This category includes the services that provide a quite wide range of technological solutions for the advancement of the other mentioned categories. In other words, they provide the infrastructure of the mobile payments such as Mobile point of sales or mPOS, application program interfaces or APIs, augmented and virtual reality AR/VR, online platforms to transfer in a secure and rapid way from a traditional business to a mobile commerce, and payment gateways, etc.
- ***P2P (peer to peer)***: The base of these services is the money transfer between persons; However, this category is not limited to only person to person money transfer. There are some innovative applications called as P2B that enable the persons to pay to businesses. It should be noted that these services are also used by big OTTs of the social media like Facebook which can leverage on their big customer base to build services around the customer experience.
- ***Others:*** The specific rare to find startups whose primary functions will not fall into any of the above mentioned standard pre-defined categories will be classified

in this category such as startups that utilize the biometric characteristics of the users as a means of the payment.

Although at first glance it may seem simple and straightforward but fetching the relevant data and extracting corresponding categories from Crunchbase is a kind tricky job and with some tolerances which needs a very careful analyses and good understanding of how the startup functions and what service in which way will be delivered to the customers by means of that functionality; the reason is that the categories specified by the Crunchbase are not completely matched with the categorization presented here.

It should be noted that in the Crunchbase site, it is possible to take advantage of different options provided to narrow down the search, which are specific categories, category groups, and descriptions.

Therefore, to limit the tolerance of the results as much as possible, it has been introduced a wider set of relevant pre-defined categories and descriptions in the Crunchbase to obtain a wider and greater dataset and then has been tried to narrow it down to the target dataset. To this end the following Category and description tags are utilized.

Category Tags

1. Bitcoin
2. *Blockchain + Bitcoin*
3. *Bitcoin + Cryptocurrency*
4. *Bitcoin + Cryptocurrency + Blockchain*
5. Bitcoin + Mobile Payments
6. Bitcoin + P2P
7. E-Commerce + Mobile Apps
8. E-Commerce + Mobile
9. Financial Services + Payments
10. *Fintech + Financial Services*
11. Fintech + Mobile Payments
12. Fintech + Payments
13. *Fintech + Software*
14. Loyalty Programs
15. Mobile Payments
16. Mobile Payments + Blockchain

17. Mobile Payments + Cryptocurrency
18. Mobile Payments + E-Commerce
19. Mobile Payments + Payments
20. Mobile Payments + Accounting + Payments
21. Peer to Peer
22. Peer to Peer + Blockchain
23. Peer to Peer + Cryptocurrency
24. Credit Cards
25. *Financial Services + Apps*
26. *Fintech + Apps*
27. *Point of Sale*
28. *Point of Sale +Financial Services*
29. *Point of Sale +Fintech*
30. Point of Sale +Mobile Apps
31. Point of Sale +Mobile Payments
32. *Point of Sale +Mobile*
33. NFC
34. NFC+MOBILE Payment

Description Tags

1. Contactless Payment
2. Contactless Payments
3. Digital Payment
4. Digital Payments
5. Mobile Commerce
6. Mobile Wallet
7. Mobile Payment
8. Mobile Payments
9. Payment Acceptance
10. Payment Solution
11. Payment Solutions
12. *Technological Solution*
13. *Technological Solutions*

The initial output of these tag searches were 1277 startups derived from Categories and 329 startups retrieved from Descriptions searches in the CrunchBase, which resulted in a relatively large total number of over 1600 startups. Therefore, some of the tags which had high redundancy degree with others, and/or they had low probability of providing uncovered data respect to other more relative tags have been

removed. The eliminated tags are highlighted by a dark shadow in the above lists. By doing so, number of startups was reduced to 635 startups got from category tag searches and 86 startups got from descriptions tag searches. In this way, the preliminary analysis has been initiated by 721 startups.

3.2 Analysis path

During the analysis of the initial dataset, it has been witnessed that still some of the startups are operating far away from the written description and associated tags with them. Thus, again some eliminations had to be applied to further refine the result, arriving at the total number of 692 startups.

There have been some considerations and modifications for the categorization respect to the previous definition of the categories presented in section 3.1.1 which will be explained as follows.

- Some loyalty program applications are considered as the **Mobile Commerce** such as Freebird (Freebird, n.d.). That means, all of the data obtained from the Loyalty tag search are not eliminated.
- It has been considered a new approach to the Mobile Commerce tag. That is, one startup category is considered as the mobile commerce if and only if all its services are delivered only through mobile device; therefore, if the startup besides the mobile app also offers the service through the website, for example, it is possible to do the checkout also through the website, it has been tagged as **E-Commerce** and has been removed from the dataset, such as (fatlama, n.d.).
- **Bitcoin** Tag has been modified to **Cryptocurrencies** Tag. It includes all the startups which offer a service considering any type of digital currency such as Bitcoin, ETH, etc and also the services mixed of digital and real currencies including trade marketplaces, money transfer, p2p payments, and digital currency wallets, which are all based on the blockchain technology, such as (celo, n.d.).

- It's been introduced a new principal tag: "**Blockchain"** tag has been used for the startups using the blockchain technology to offer different services such as digital identity, in car payment, technological security, payment security, etc. such as (ternio, n.d.).

  Important Note: It should be emphasized that this tag has been introduced during the research to help to refine more and better categorization of the data; However, later during the procedure of the categorization, most of them have been merged to the other categories, and the remaining has put aside of the analyses due to the consistency to the past available researches. Nonetheless, it can be observed that this technology is very diverse and is growing rapidly. Therefore, it can be considered to introduce this tag to the future researches, and it will for sure contain important information.
- **credit card** Tag has been used for the ones who issue only the credit cards and consequently they have been removed; However, the ones who issue a credit card along with a mobile wallet are kept under **mobile wallet** tag with credit card in the secondary tag, such as (petalcard, n.d.).
- Mobile POS and Smart POS providers are categorized under the **payment acceptance** tag, such as (kashing, n.d.).

Continents

The continent association has been considered as Asia, Africa, North America (including Mexico), South America, Europe (including Russia), Oceania, & Middle East (including Turkey & Israel).

This association is consistent with National Geographic definition (National Geographic, n.d.), except for one minor change which is the extraction of the Middle East from Asia continent. This is done to enable better examination of the numbers, specifically in terms of the numbers of startups and investment funds, because a huge difference between the Middle East region and east or central Asian fast-growing countries has been recognized like India, which is rapidly becoming digitalized.

Activity legends

The last but not the least is to set activity legends that are described in the table 3-1.

Table 3-1 The Activity Legends definition

1	**Startups present in the 2017 census born from 2013 onwards**
1*	Startups present in the 2017 census acquired or closed
2	New 2018 startups born from 2014 onwards

3.2.1 Missing Data Acquisition and Matching

As mentioned before, the information on the Crunchbase is provided by the startups themselves and thus, in some cases, there were some data missing or obsolete or expired links. Therefore, it should have done a significant effort to match the provided information by the other sources like an official LinkedIn account of the company, or Social Media accounts and update the latest information.

In other cases, even in the website of the startup, there were not enough explanations about services or functionalities of the applications, as they are in the early stages of funding or they do not have enough resources to update regularly their websites' information. Consequently, whenever and wherever it was possible, it has been attempted to install the application and using the service in order to deepen the understanding of the way company works and delivers its service in order to minimize the detection errors.

The preliminary result of these matching efforts is listed in table 3-2, which states the 371 startups of the total acquired data are derived from the dataset and categorized as the pre-defined categories (see table 3-2, Left column). The rest of the data are also categorized in some way to have a general view of the numbers; However, these categories are not included in the perimeter of this study. Therefore, they should be excluded from the results (see table 3-2, Right column).

Table 3-2 Pre-analysis result of the data acquired from Crunchbase.

Category	No. of censused startups	Category	No. of censused startups
Tech. Solutions	65	Financial Services	53
P2P	6	credit card	11
Other	18	Loyalty + Tech. solutions	31
Mobile Wallet	86	fintech	31
Mobile Commerce	77	E-Commerce	195
Cryptocurrencies	73		
Blockchain	18		
Payment Acceptance	28		
Total Obtained	**371**	**Total Out of Scope**	**321**
Total ALL 692			

As indicated in section 3.1.2, the Blockchain category was further modified and merged either in Cryptocurrencies or put aside of the data. Also, there has been done a comparison with the data of 2017, then a set of data which are not placed in 2018 perimeter is added to these numbers to match the dataset consistency and enable it to be comparable with the results of the previous years.

In the next chapter, the analysis will go deeply into the data analysis, category by category, country by country, continent by continent, regarding the funding amounts, targets, etc.

CHAPTER 4
INTERNATIONAL STARTUP TRENDS

In the last chapter, the methodology and data extraction were explained. In this chapter, it will be presented the detailed analyses.

4.1 Startup Census Numbers

As previously mentioned, matching the data coming from different resources including Crunchbase, the company website, and social media, and the previous census is not an easy task. With all differences, missing data, and inconsistencies, at the end by doing extensive research and analysis and careful consideration for the categorization, the census of the year 2018 has been obtained. The direct results are demonstrated in the tables 4-1.

Table 4-1 Count of startup by primary tag

Row Labels	Count of Organization Name
Cryptocurrencies	44
Mobile Commerce	86
Mobile Wallet	103
Other	10
P2P	1
Payment Acceptance	42
Technological Solutions	44
Grand Total	330

Table 4-1 states that the Mobile Wallet category is pioneering in the field by 103 startups, followed by the Mobile Commerce by 86 startups. It shows the importance of the wallet in the recent year on which a lot of startups have been focused. The percentual distribution of the startups respect to categories is shown in figure 4-1.

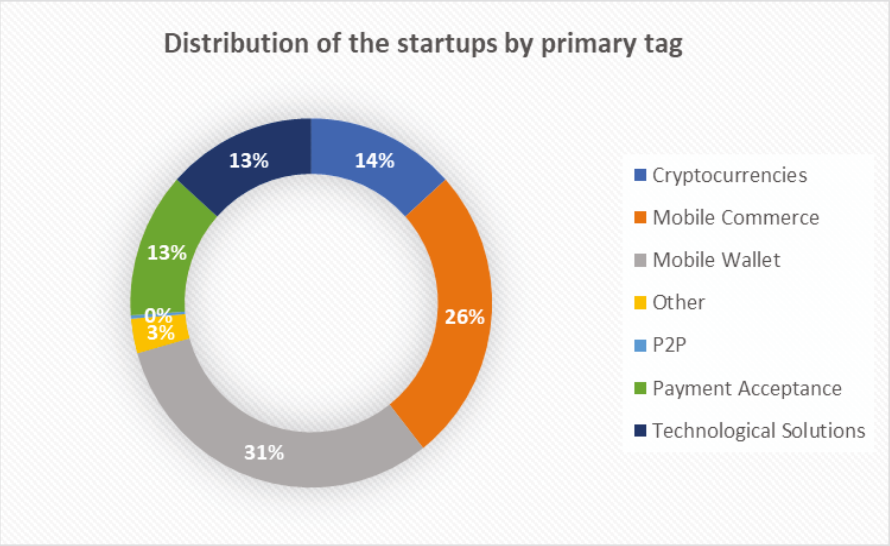

Figure 4-1 Distribution of the startups by primary tag

There has been identified only one startup in the P2P category. The reason can be sought in the way that only the applications which are designed exclusively for sending money from person to person are considered for this category. Thus, most of the applications which provide this service are either using Blockchain technology or have an inclusive wallet application in which the P2P service is provided.

Table 4-2 Sum of total funds by the primary tag (US$)

Row Labels	Sum of Total Funding ($US)
Cryptocurrencies	675,256,339
Mobile Commerce	3,837,710,049
Mobile Wallet	1,396,648,955
Other	11,140,810
P2P	154,187
Payment Acceptance	361,096,480
Technological Solutions	273,342,345
Grand Total	6,555,349,165

Table 4-2 shows that more than $3.8 billion of the funding is done over the Mobile Commerce. The two important categories from the table 4-2, could attract more than $5 billion which is a huge part of total funds, almost equal to 80% of the whole. The percentual distribution of the funds respect to categories is shown in figure 4-2.

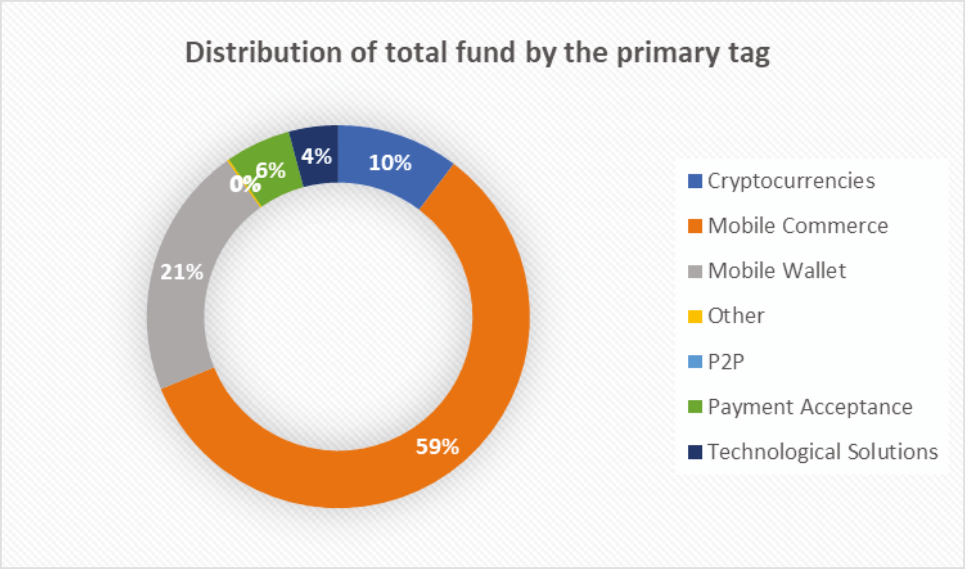

Figure 4-2 Distribution of total fund by the primary tag

Although it may not seem so important at first glance, the target that the startup will consider delivering its service can affect its approach in creating the design and features of the service. It can be interesting to have some numbers to give a general idea that the whole ecosystem is triggered to which direction.

Table 4-3 Count of startup respect to the target

Row Labels	Count of Organization Name
B2B	70
B2B2C	64
B2C	181
C2C	15
Grand Total	330

As can be seen in table 4-3, business to customer approach by far is the leader strategy in the market. Accordingly, this approach has attracted a higher share of funds respecting to other categories (see table 4-4).

Table 4-4 Sum of Total funds based on the target

Row Labels	Sum of Total Funding ($US)
B2B	321,806,627
B2B2C	932,058,874
B2C	5,289,946,614
C2C	11,537,050
Grand Total	6,555,349,165

This amount comprises over 80% of the total funds. The different percentual shares are depicted in figure 4-3.

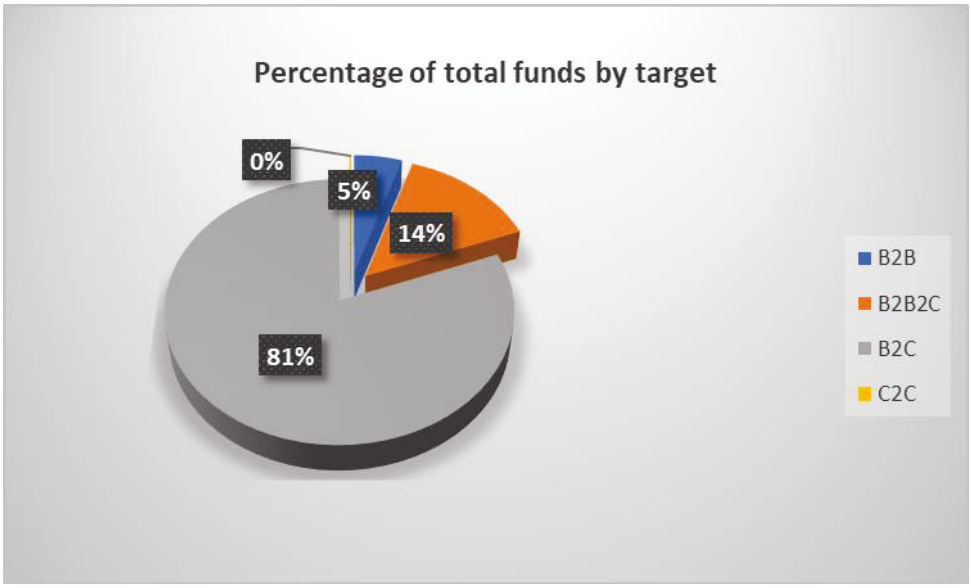

Figure 4-3 Percentage of total funds by target

Another interesting information could be the number of startups in each continent, which is presented in table 4-5. It should be noted that the Middle East data are considered separately respect to Asia for having different ecosystem and peculiarities.

Table 4-5 Count of startup by continent

Row Labels	Count of Organization Name
Africa	9
Asia	59
Europe	90
Middle East	14
North America	135
Oceania	12
South America	8
(blank)	3
Grand Total	330

It can be clearly seen that with no surprise North America is the absolute leader in the number of startups by being the home to over 130 startups. Followed by Europe with 90 startups. The percentual distribution is depicted in figure 4-4.

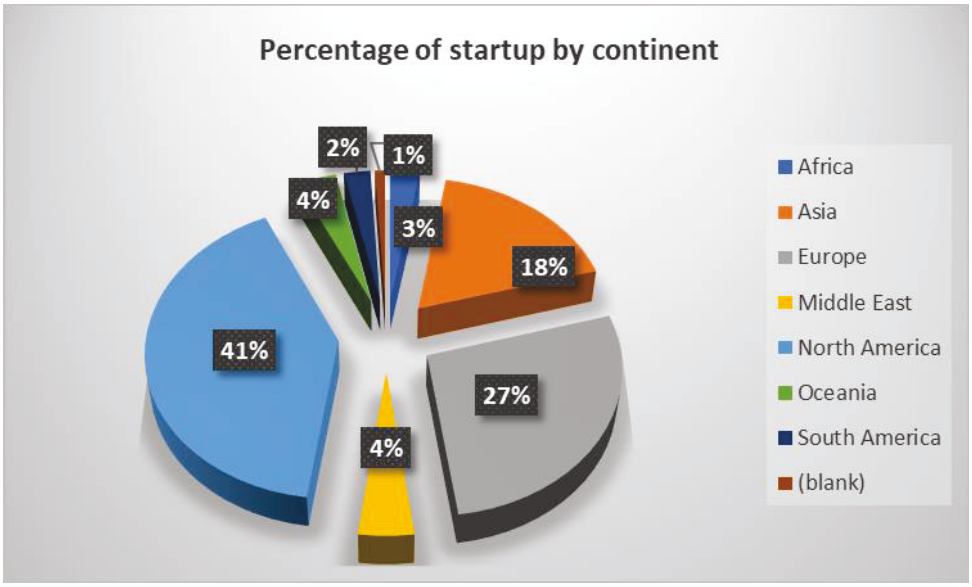

Figure 4-4 Percentage of startup by continent

It should be noted that “blank” field in the figure 4-4 is represented the startups in which the headquarter location could not be extracted from none of the resources available. The funding data of each continent is presented in table 4-6.

Table 4-6 Total funds by continent

Row Labels	Sum of Total Funding ($US)
Africa	52,435,322
Asia	3,782,357,055
Europe	937,031,834
Middle East	91,926,810
North America	1,592,320,137
Oceania	62,373,007
South America	13,555,000
(blank)	23,350,000
Grand Total	6,555,349,165

By looking at table 4-6, it can be deducted that unlike the leading number of startups by North America and Europe, the most funding has been done in Asia. This peculiarity can be better visible in the following figure. In which apparently Asia is sustaining more than half of the whole funding in the world. The percentual share is depicted in figure 4-5.

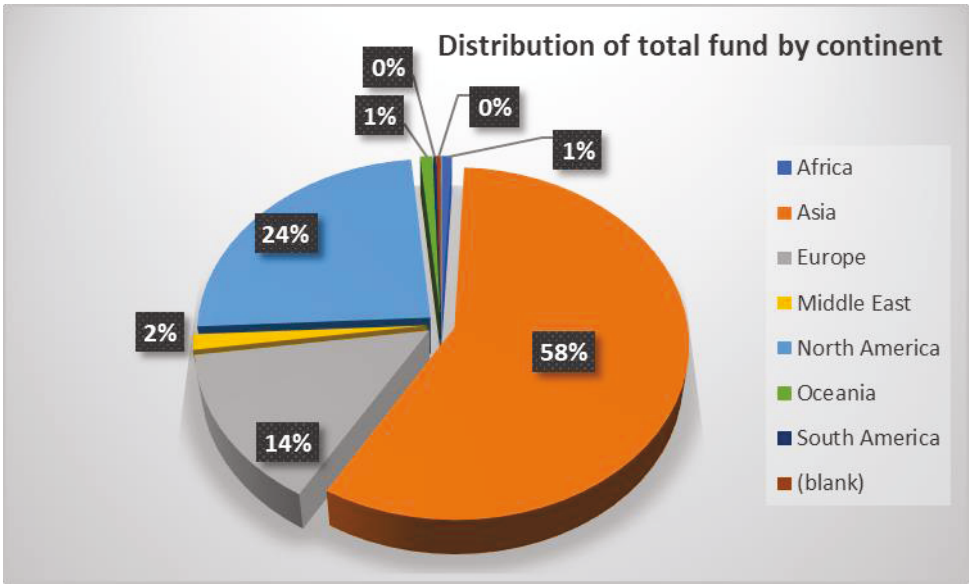

Figure 4-5 Distribution of total fund by continent

To better analyze this peculiarity, one should go deeper through data of the Asian continent, maybe country by country. The total funds of each country in Asia is presented in table 4-7.

Table 4-7 Total funds in Asia

Row Labels	Sum of Total Funding ($US)
Cambodia	25,000
China	2,999,931,991
Hong Kong	102,195,437
India	321,676,255
Indonesia	61,670,000
Japan	46,681,619
Malaysia	1,446,135
Myanmar	19,400,000
Pakistan	3,400,000
Philippines	14,022,696
Singapore	11,707,922
South Korea	200,000,000
Thailand	-
(blank)	200,000
Grand Total	**3,782,357,055**

From table 4-7, the source of the peculiarity of funding in Asia can be easily identified: China! The figure for funds is somehow incredible. That is, China alone has funded almost $3 Billion. In the next places are India, South Korea, and Hong Kong with more than a $100 Million investment are following China as the leader.

By going to further details, more interesting results can be deducted which show how this giant economy is investing in the new digital technology to conquer the world. The detailed funding of Chinese startups is presented in table 4-8.

Table 4-8 Detailed funding of Chinese startups

Organization Name	Target	Primary Tag	Total Funding ($US)
BitoEX	B2C	Cryptocurrencies	12,000,000
Ofo	B2C	Mobile Commerce	2,151,231,991
MissFresh	B2C	Mobile Commerce	412,000,000
Shouqi Limousine & Chauffeur	B2C	Mobile Commerce	229,000,000
FASHORY	B2C	Mobile Commerce	Undisclosed
Black Fish	B2C	Mobile Wallet	195,000,000
Wosai	B2B	Payment Acceptance	Undisclosed
Coolhobo	B2C	Technological Solutions	700,000

It can be seen from the table 4-8, only four Chinese startups together have received around $3 billion funds. In a very special case, OFO has received more than $2 billion which is unique of its kind. It should be noted that OFO is a mobile commerce platform which is delivering mobility sharing services and specifically in the bike sharing application (OFO, n.d.).

4.2 Discussion and Results' Analysis

In this section, there has been done an effort to understand the numbers over time which implicates some trends. Also, some comparisons by the previous researches will be presented.

The first indicators to be considered are the numbers of the startups and the total sum of the funding during the past five years, which is presented in table 4-9.

Table 4-9 Total funds and count of startup by year

Row Labels	Sum of Total Funding ($US)	Count of Organization Name
2014	2,991,981,452	66
2015	2,078,476,437	84
2016	511,047,515	79
2017	970,834,179	80
2018	3,009,582	21

By looking at table 4-9, one can immediately figure out the decreasing trend in both the number of startups and the total fund. To understand better this trend, average total fund per year is depicted in figure 4-6.

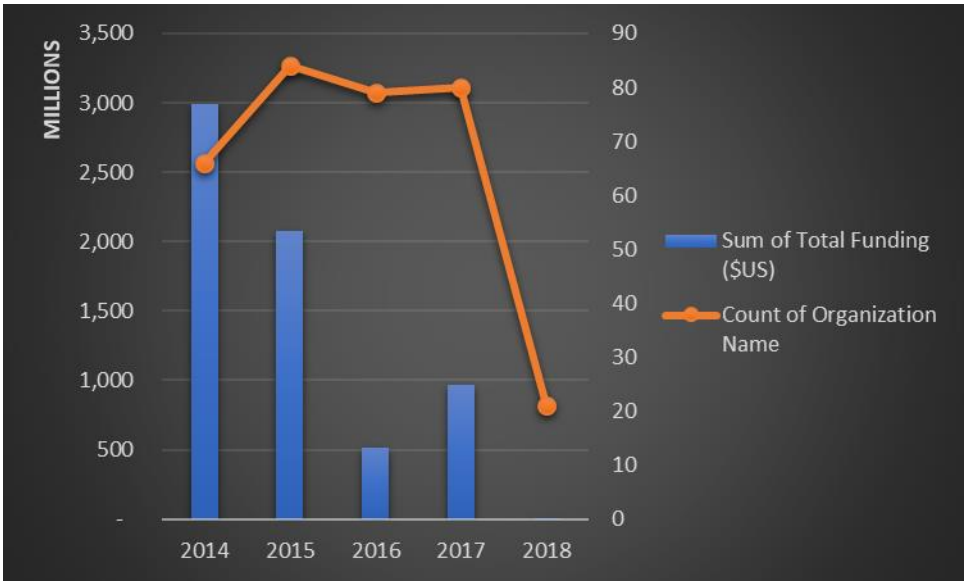

Figure 4-6 Average total fund and startup count by year

To see if it is possible to define a summit for this trend, the past data are used to compare with new data and make the trend more comprehensive, which is depicted in figure 4-7. The same trend considering the sum of the total fund is also illustrated in figure 4-8.

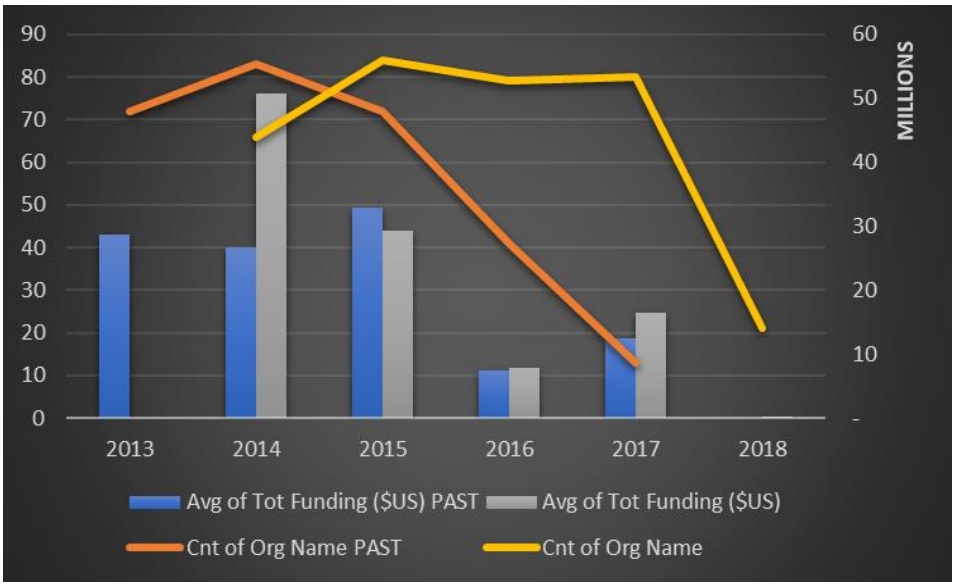

Figure 4-7 Trend of Average total fund and startup count by year

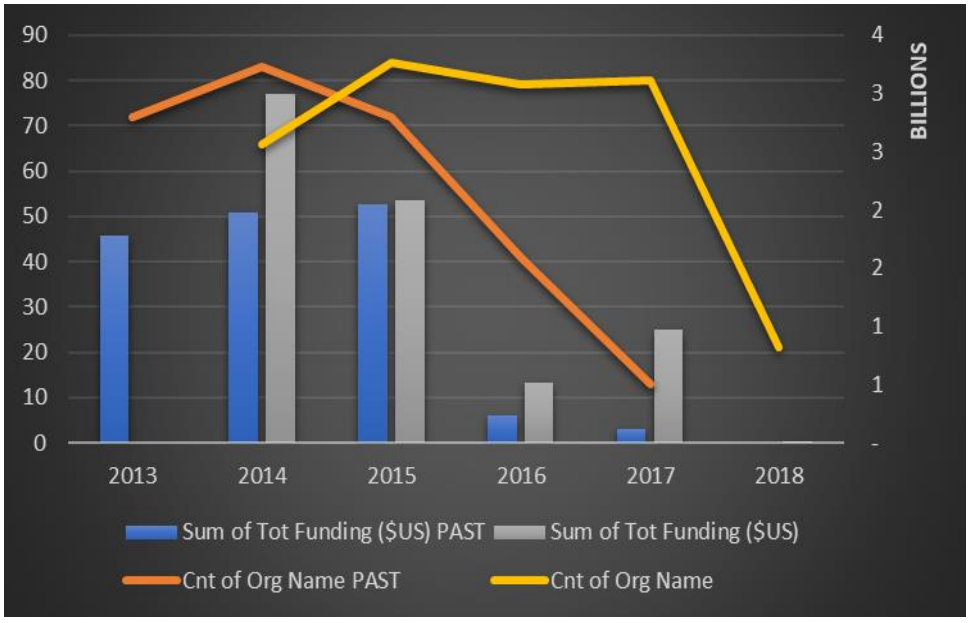

Figure 4-8 Trend of Sum of the total fund and startup count by year

By a careful look at the figures 4-7,8, it could be inferred that the year 2014 can be called the golden year of the funding startups as it has the peak in the total sum of funds, an average of funds per startup, and the number of startups. After 2014, the volume of funds and numbers of startups have been decreased year by year, till 2018 which is so low (only $3 million) comparing to the previous years that is not visible in the chart. A part of this may come back to the not announcing the funding on the Crunchbase site and waiting for the end of 2018 to announce the final fund; However, it cannot take the whole responsibility for such a huge decrease.

Another trend that should be observed is the total startup count and average total fund of the years 2018 and the year 2017 respect to different categories. In the table 4-10, the numbers of the year 2018 is presented followed by the comparison chart illustrated in the figure 4-9, which combines the trends of startup numbers and average total funds over the past five years, comparing the results of 2018 with 2017 in a unique chart.

Table 4-10 Total startup count and Average fund by primary tag

Row Labels	Count of Organization Name	Average of Total Funding ($US)
Cryptocurrencies	44	18,757,121
Mobile Commerce	86	54,824,429
Mobile Wallet	103	17,032,304
Other	10	1,392,601
P2P	1	154,187
Payment Acceptance	42	11,284,265
Technological Solutions	44	7,387,631
Grand Total	**330**	**24,644,170**

As can be observed by chart 4-9, all the numbers in the year 2018 are increasing respect to previous year except than Mobile Wallet category. However, the mobile wallet received the highest amount of fund among all the categories. On the other hand, the payment acceptance category has experienced a reduction in average fund reception.

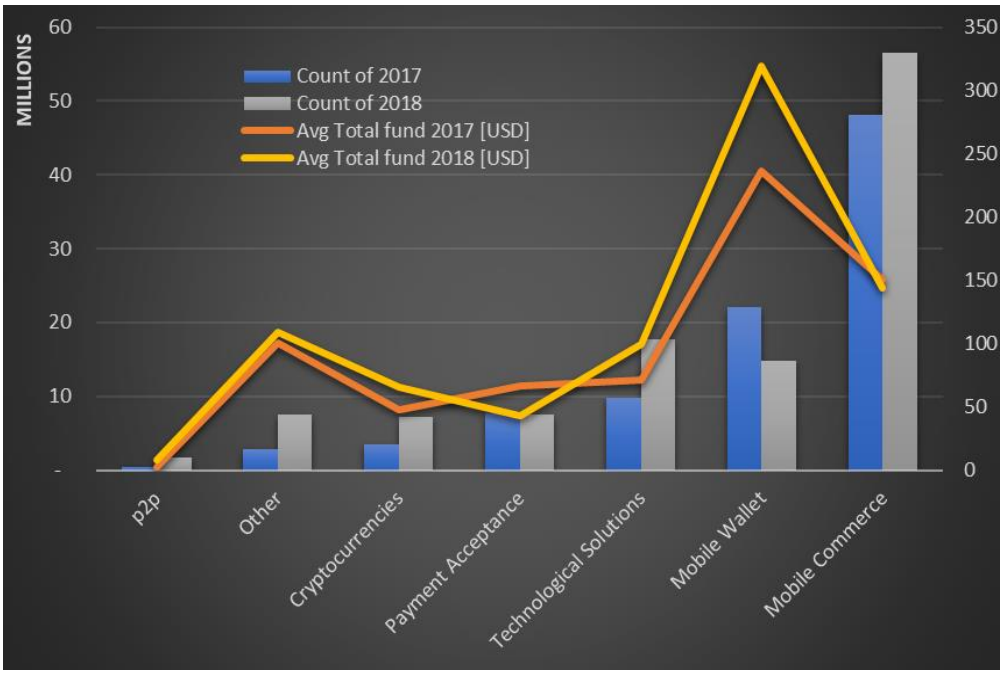

Figure 4-9 Trend of startup count and Average total fund by primary tag

There can be compared different cross indicators and metrics together for deriving the different trends such as

- (Continent) vs (Prime tag)
- (Continent) vs (Founding date)
- (Prime tag) vs (Founding date)
- (Prime tag) vs (Target)
- (Continent + Target) vs (Prime tag)
- (Continent + Activity legend) vs (Prime tag)
- (Continent + Founding date) vs (Prime tag)
- (Prime Tag + Founding date) vs (Continent + Headquarter country)
- Etc.

In the following figures, the most relevant of the abovementioned combinations are presented which are the first three cross categories. The following charts are produced by the 100% stacked column chart in Excel which represents both the count number and intuitive percentage of each assigned indicator respect to the base axis. Figure 4-10 demonstrates the startup number trends of each continent for the past five years. Figure 4-11 though, illustrates the startup number trends of each prime tag over the past five years. Note that in figure 4-11, consideration of the P2P category does not make any sense for the scarcity of the startups in it.

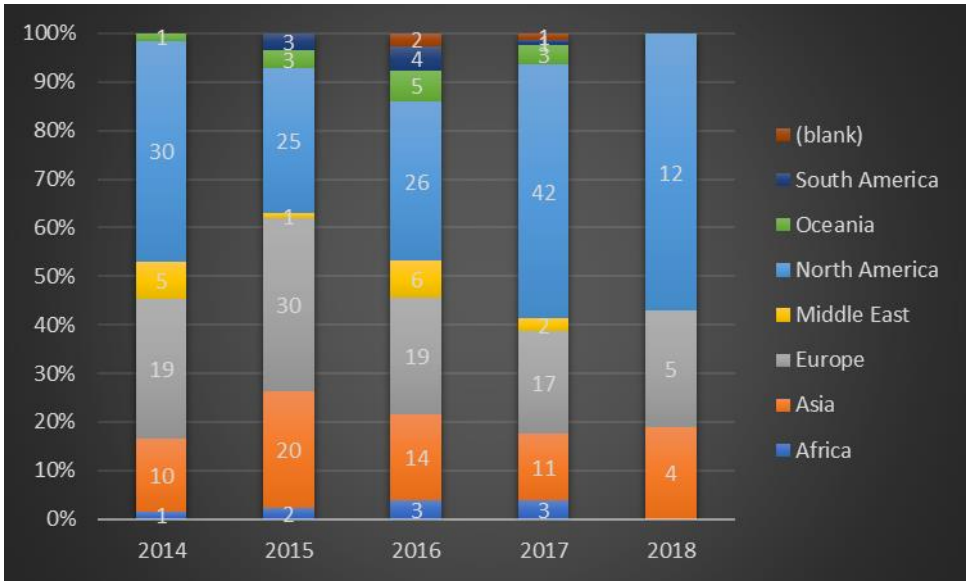

Figure 4-10 Distribution trend of the startups of the continents over time

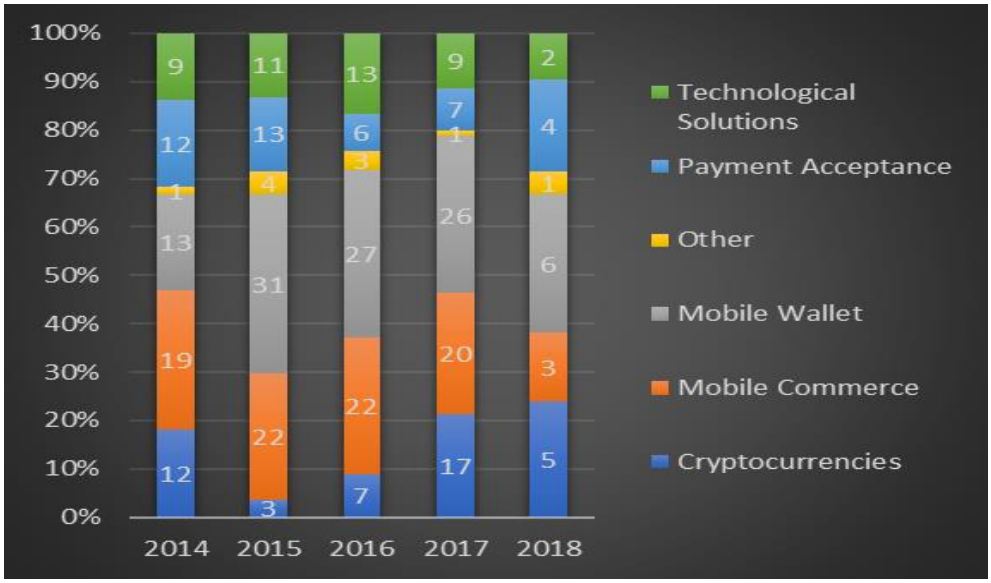

Figure 4-11 Distribution trend of the prime tag over time

One trend that has been postponed is the sum of the total fund by continent. To capture this trend, it should has applied a modification to the data of the previous year. The reason is that in the data of the previous year, categorization of the continents was a bit different from the categorization of this year. Particularly, there were existing Central America in the categories and there was no Middle East. To be able to capture the right trend, the data of Central America with North America have been merged together, then the data of the Middle East have been extracted from Asia. Thus, obtaining the same pattern of the categorization as used for 2018. The result has been shown below. Figure 4-12 depicts the trend of the sum of the total fund and the total number of the startups by the continent over the past five years comparing the data of 2018 and 2017 in the same picture. Figure 4-13 demonstrates the startup number trends of each continent for each prime tag. It should be note that the P2P category is not considered in figure 4-13, because there is only one startup in this category and obviously it belongs to only one continent.

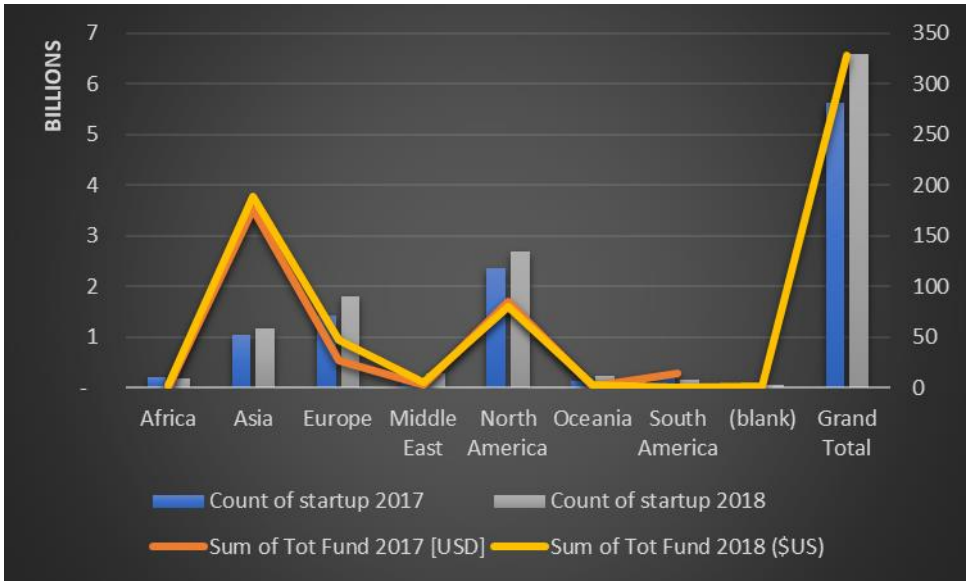

Figure 4-12 Trend of the sum of the total fund and startup number by the continent

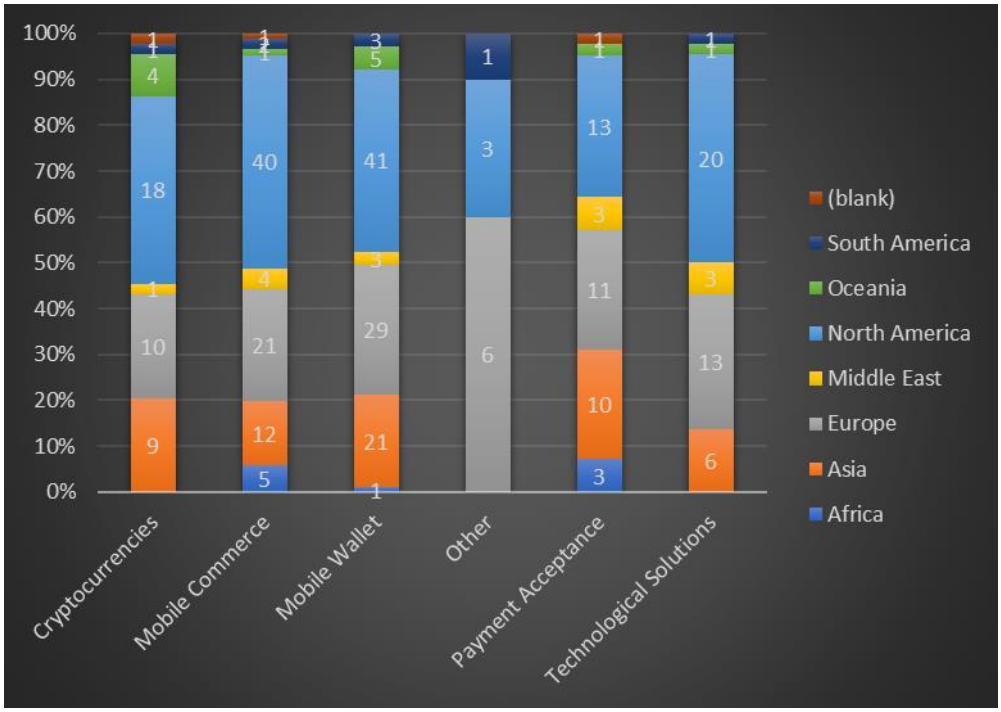

Figure 4-13 Distribution trend of the continent by prime tag

The next indicator which will be compared between two consecutive years is the number of the startups for every single country, to identify the pioneering countries in the field. It should be mentioned that since there are too many countries, here is

presented the top ten countries of each year by the highest number of startups. Table 4-11 presents the data in 2018.

Table 4-11 Top 10 countries with the highest No. of startups 2018

Country	No.
United States	120
United Kingdom	36
India	17
Australia	10
Canada	10
China	8
Singapore	8
Indonesia	7
Netherlands	7
France	6

Table 4-12 presents the data in 2017.

Table 4-12 Top 10 countries with the highest No. of startups 2017

Country	No.
United States	105
India	20
United Kingdom	20
Canada	10
Australia	7
China	7
Brazil	6
France	6
Germany	5
Indonesia	5

By comparing the two tables 4-11 and 4-12, one can recognize the top three countries are the same by the leadership of the United States increasing from 105 to 120 startups. Another interesting point is the emergence of Singapore in the top ten by 8 startups which shows a huge investment by the country in the field.

It should be noted that above each Primary Tag, it is also assigned a Secondary Tag to every single startup which represents the most important feature of its activity after the prime tag.

It is interesting also to take a look at this kind of ranking based on the countries by the sum of the total fund per country. The table 4-13 presents the data for 2018.

Table 4-13 Top 10 countries with the highest total sum of funding 2018

Row Labels	Sum of Total Funding ($US)
China	2,999,931,991
United States	1,549,276,115
United Kingdom	498,087,802
India	321,676,255
South Korea	200,000,000
Spain	177,970,898
Hong Kong	102,195,437
Lithuania	100,100,000
Israel	68,334,014
Indonesia	61,670,000

Table 4-14 presents the counterpart data of the previous year.

Table 4-14 Top 10 countries with the highest total sum of funding 2017

Row Labels	Sum of Total Funding ($US)
China	2,896,678,070
United States	1,539,006,335
Brazil	285,367,969
South Korea	277,200,000
Canada	165,127,820
United Kingdom	140,001,701
Germany	139,935,468
Japan	121,960,000
India	78,981,540
Thailand	45,400,000

By comparing the two tables 4-13 and 4-14, interesting results can be inferred. First, both China and United States with almost the same and constant amount of investments are leading the top two places.

In the next places, the United Kingdom in the third place and India in the fourth one, have been experiencing a magnificent jump over all other countries to reserve a top place for themselves. This could not be achieved without having invested an incredible amount of several hundreds of million dollars, close to half a billion dollars, and roughly 400% increase respect to the previous year amount. This is a real competition between the two countries and would be interesting to know next year numbers.

The last but not the least is the disappearance of the advanced countries like Canada, Germany, and Japan from the top ten list and emergence of the new players like Spain, Hong Kong, and Israel which indicates that this field is getting popular and many countries are investing more and more in this area.

Because of the high diversity of the companies, the number of the associated second tags were about 50 different tags. To achieve a rough idea about the secondary tag distribution over the main categories, it has been done a clarification to enable more harmonized secondary tags. That is, by doing a kind of rounding up the closely related tags together, it could be possible to reduce the numbers from 48 tags to 20 secondary tags. The acquired data is presented in a series of tables seprately for each prime tag as follows.

Table 4-15 Data of Secondary tag vs Cryptocurrencies Prime tag

Row Labels	Cryptocurrencies
Banking	2
Credit card	2
E-commerce	7
Marketplace	1
Payments	3
Wallet	17
Money Transfer	6
Technology Provider	2
Payment Ratification	4
Grand Total	**44**

It can be inferred immediately from table 4-15 that most of the startups in the field of cryptocurrencies are providing a Wallet service, which is basically a mobile wallet

that works with the virtual money of any kind. They can be used as a wallet or simply a safe-box to secure users' digital currency. Therefore, they are categorized separately than a normal wallet. A considerable number also supply ecommerce and p2p services.

Table 4-16 Data of Secondary tag vs Mobile Commerce Prime tag

Row Labels	Mobile Commerce
Banking	1
Booking	30
Delivery	8
E-commerce	2
Marketplace	23
Mobile App	2
Payments	7
Promotion & Loyalty and Payment	6
Wallet	1
Money Transfer	6

In the field of mobile commerce, it can be seen from the table 4-16 that the most popular service is about Booking. The booking service can be done in a variety of businesses and on the one hand, facilitates forecasting of the demand and service delivery for the merchant, and on the other hand it would be more convenient for the customers. The next popular service in this category is Marketplace, which is basically a kind of online bazaar and can be provided in various fields. These marketplaces can be one-sided, in the sense that the goods on the market can only be provided by the business owner(s), or two-sided, which the customers are also able to sell and purchase goods and services among each other.

Table 4-17 confirms the previous statement about mobile wallets which says they are primarily designed for payment. The next popular service is Promotion and Loyalty programs which has been revolutionized by the mobile reward programs. Most of the time mobile wallets embed more than one of these services in their mobile application. An interesting point is the high number of credit cards tag in the mobile wallet category, specifically 15 startups. That includes the mobile wallets which

issue also a credit card or debit card, that can be monitored, controlled, accessed or blocked via the wallet they are associated to.

Table 4-17 Data of Secondary tag vs Mobile Wallet Prime tag

Row Labels	Mobile Wallet
Banking	2
Bio ID	1
Booking	1
Check out	4
Credit card	15
E-commerce	1
Finance	6
Mobile App	1
Payments	38
Promotion & Loyalty and Payment	26
Wallet	2
Money Transfer	6
Grand Total	**103**

Table 4-18 Data of Secondary tag vs Technological Solutions Prime tag

Row Labels	Technological Solutions
API	2
AR/VR	2
Bio ID	1
Check out	1
Credit card	2
Cybersecurity	2
E-commerce	3
Finance	2
Marketplace	2
Mobile App	3
mPOS	3
Payments	13
Promotion & Loyalty and Payment	3
Wallet	1
Payment Ratification	4
Grand Total	**44**

Table 4-18 demonstrates that technological services are substantially diverse but mostly active in the field of payments.

Table 4-19 Data of Secondary tag vs Payment Acceptance Prime tag

Row Labels	Payment Acceptance
API	4
Check out	2
E-commerce	3
Finance	1
Mobile App	1
mPOS	7
Payments	15
Promotion & Loyalty and Payment	1
Money Transfer	1
Technology Provider	7
Grand Total	**42**

Table 4-19 acknowledge that with no surprise the Payments is the most popular service of the payment acceptance category.

Table 4-20 Data of Secondary tag vs P2P and Others Prime tags

Row Labels	Other	P2P
Bio ID	333	
Delivery	2	
Mobile App	1	
Payments	2	11
Promotion & Loyalty and Payment	1	
Technology Provider	1	
Grand Total	**10**	**1**

Table 4-20 highlights the emergence of some innovative startups in the field payments using the biometric characteristics of the user called Bio-ID. There was only one p2p startup censused which was also in the payment service.

Table 4-21 wraps up all the 20 secondary tags by the total number in all the primary tags. Not surprisingly, the Payments category by having 79 startups, is the pioneering tag. The next hot topics include Loyalty programs by 37 startups, Booking by 31, and Marketplace with 26 startups.

Table 4-21 Total number of startups in each Secondary tag

Row Labels	Grand Total
API	6
AR/VR	2
Banking	5
Bio ID	5
Booking	31
Check out	7
Credit card	19
Cybersecurity	2
Delivery	10
E-commerce	16
Finance	9
Marketplace	26
Mobile App	8
mPOS	10
Payments	79
Promotion & Loyalty and Payment	37
Wallet	21
Money Transfer	19
Technology Provider	10
Payment Ratification	8
Grand Total	**330**

In the next section, a deep focus on the Italy numbers and statistics will be presented.

4.3 A Focus on Italy

A detailed analysis in the previous section on the overall startup ecosystem and international atmosphere has been done; However, after all this research has been done in Italy and without the support of the Observatory of the Mobile Payment at Politecnico di Milano it would not be possible to achieve these results. Thus, it is fair enough to present a special focus on Italian numbers and statistics.

First of all, by considering the year 2018 data it can be obtained the all Italian startups in the database, presented in the table 4-16.

Table 4-22 The Italian startups of 2018 census

Organization Name	Target	Primary Tag
Prizeme	B2B2C	Mobile Wallet
In Time Link	B2B2C	Mobile Wallet
Splitty Pay	B2B	Payment Acceptance

At the first glance, it seems weird that there are only three startups in the category; However, by comparing to the results of the previous year (table 4-17), it can be immediately inferred that there is not a huge difference between two consecutive years.

Table 4-23 The Italian startups of 2017 census

Organization Name	Target	Primary Tag
YooGo	B2C	BitCoin
Satispay	B2C	Mobile Wallet
Supermercato24	B2B2C	Mobile Commerce
Sinba	B2B2C	Payment Acceptance
Tinaba	**B2C**	**Mobile Wallet**

It could be identified that the numbers are not so different but reduced from 5 to 3. One can wonder why none of the previous year startups could reserve a place in this year database. The following analysis will go through each to answer this question.

YooGo is founded in 2013, thus is located out of the range of five years.

Satispay is also founded in 2013, again out of the range of the perimeter.

Supermercato24 is founded in 2014 and received funds in 2018. Up to this level everything is fine; However, the issue that makes it out of the target is the difference in the methodology definition explained in the section 3.1.2, that is, by the new modified definition one startup belongs to the mobile commerce category if and only if all of its services is delivered through mobile channel. In other words, if the service is delivered by both mobile and web platform, that service is considered as e-commerce and not a mobile commerce. In this special case, the service has been tested and discovered that it is possible to sign up, to order, and to do the check out

all from the service web platform without a single touch of the mobile device. So, it is considered out of the perimeter of the research.

Sinba is founded in 2013, and simply out the perimeter.

Tinaba is a Mobile Wallet founded in 2015 and has received funds in 2017. It seems that it has all the criteria for falling inside the perimeter. Thus, it will be considered as the new item.

This example clearly shows how the reliability of the Crunchbase can be degraded by eliminating some of the startups from the search results. It was known before that there can be some tolerances because the information provided in the Crunchbase is self-explanatory by the company owners. It may happen that the Tinaba owners did not enter the last funding round data on the Crunchbase or the search engine did not generate the right results. Either way, some other resources to prevent such tolerances should be considered.

One of them was what has been done above that is, comparing two or more consecutive year results. The other is to use different resources other than the Crunchbase. In this case, the latest research data has been utilized on the Italian startups thanks to the Observatory of the Startup Intelligence (Ossevatorio.net, n.d.) to recognize better and refine further the participant in this ecosystem.

After intensive analysis through several hundreds of entries and 4 rounds of elimination, it could be retrieved seven startups that were the initial candidates to fall into the circle presented in the table 4-18.

Table 4-24 The candidates from external resources

Organization Name	Founding date	Last funding date
Drinkout	2015	ND
Eatsready	2017	2018
NOSPay	2014	ND
Paybox	2014	2015
SOLO	2014	ND
Soulkitchen.bio	2015	2018
Tinaba	2015	2017

These entries are all fine in terms of the founding date, and activity. The determining factor here is the last funding date.

Tinaba, as explained before, is qualified.

Soulkitchen.bio is e-commerce providing semi-finished food to the bars and hotels and restaurants. Although it has all other criteria, it seems out of the perimeter.

Eatsready also seems qualified; However, by checking the website it is possible to order online without using mobile. Again, falling into the e-commerce category. Paybox is out of circle because it has not received funding in the last two years. There are remaining the three startups which were not possible to guarantee the data. Therefore, to make a certain judgment they have been removed from the database. Finally, altogether the Italian startups van be presented by the table 4-19.

Table 4-25 The Italian startups from all resources

Organization Name	Target	Primary Tag
Prizeme	B2B2C	Mobile Wallet
In Time Link	B2B2C	Mobile Wallet
Splitty Pay	B2B	Payment Acceptance
Tinaba	B2C	Mobile Wallet

By adding Tinaba, Italy can upgrade its position in the countries from position 23 up to the 13 to stand side by side on countries such as Switzerland, Sweden, Mexico, Brazil, Estonia, etc.

In terms of total fund there is no info about Prizeme, but from Crunchbase could be obtained both In Time Link and Splitty Pay together have been received around $600,000. On the other hand, Tinaba has received €30 million only in the last funding round which is a kind of surprise. It may only be compared to Satispay from previous years which has received over $50 million.

If it is considered roughly total funding amount of Italy equal $35 million, it can be deducted the rank of Italy will be improved dramatically and will be upgraded from 46 up to 17 right after Canada and upper than Switzerland.

Another issue that is obvious from the data about Italy is that Italian startups are very active in the Mobile Wallet category.

CHAPTER 5
MOBILE PAYMENT EVOLUTION

In this chapter, future trends, challenges and opportunities, and possible scenarios for Mobile Payments will be presented.

5.1 Future Challenges and Opportunities

Mobile communication along with new technologies provide attractive business opportunities. Mobile payment solutions provided by vendors must improve to support complicated applications running on client mobile devices (M. Kadhiwal, 2007). Simultaneously, existing m-payment systems must continuously be adapted by designers to permit customers to leverage on the associated benefits while guaranteeing secure and robust payment transactions. Several challenges and opportunities are as follows.

5.1.1 5G Technology

The next generation of the available 4G network technology is the 5G mobile communications technology. This technology empowers the users to transfer gigantic data files including high-quality digital movies almost without limitation. It permits customers to enjoy a wide range of services like 3D movies and games, real-time streaming of ultra-high-definition content, and remote medical services. Other

features of 5G makes available software-defined radio and flexibility in encryption method used.

Furthermore, 5G will upgrade latency, battery consumption, cost, and reliability, which eventually decreases the communications cost over wireless networks during the payment transactions. Miscellaneous wireless networking technologies play a key role in the deployment of 5G networks. Nevertheless, the imbalance of security solutions employed by different wireless, mobile, cellular networks causes end-to-end security solutions still an essential challenge that must be resolved to reinforce future secure m-payment systems and applications (J.T. Isaac, 2014).

5.1.2 Cloud Computing

A cloud-based m-payment system is a kind of proximity payment that keeps payment credentials on a remote server rather than at the mobile device which will be further employed to validate the payment transaction. To apply this solution, both the consumer and the merchant must download the cloud-based application and register to the service. The physical mobile phone might not be necessarily present to complete the payment, determined by the precise definition of the solution. Customers can access their account information in the cloud via mobile devices. Moreover, payment notification can be sent via email or SMS text messages immediately after a cloud payment is completed (M. Crowe, 2012).

Notwithstanding the advantages provided by cloud-based m-payment systems, some security issues are still decoded. For instance, if the cloud server is attacked, stored payment credentials and payment data in the cloud could be compromised. In addition, transmission of payment data should not be handled through SMS or email because cloud platforms are not encrypted. In the end, data privacy stands a fundamental concern for payment data stored in the cloud, in case of data leakage to other businesses without the consumer's explicit consent.

5.1.3 Security versus Performance

security levels of Payment systems that execute mobile transactions in wireless networks must be the same as those designed to handle electronic payment transactions on fixed networks. Besides, mobile payment applications should be well matched with the existing traditional electronic payment infrastructure allowing the existing infrastructure to continue its operation. Despite that, the payment transactions execution in wireless ambient is distressed from several limitations that need innovative solutions to be found by designers of wireless payment systems to address these critical issues.

Decreasing the computational requirements of the conventional secure protocols can possibly resolve the issue. Replacing highly demanding cryptographic operations with smarter and more efficient cryptographic protocols needing less computing and memory resources also could be a relief. Consequently, there should be a trade-off between transaction performance and its security of mobile payments (J.T. Isaac, 2014).

5.1.4 Restricted Connectivity Scenario

Mobile payment systems offered in the last decade have been mostly based on a full connectivity scenario. That is, all the system units are directly connected to each other. In these mobile payment systems, the situation in which two units of the model cannot communicate directly with each other is not considered. This situation can happen because of communication limitation. For instance, a merchant who cannot communicate directly with the payment gateway as a result of the absence of the Internet. In this case, the situation is usually called as restricted connectivity. In this environment, a restricted connectivity scenario will be defined as one in which two units of a mobile payment system cannot communicate with each other directly and must do it via a third party. Notwithstanding the new obstacles brought by the restricted connectivity scenario, mobile payment systems designers should guarantee

the same security levels as those based on the full connectivity scenario (J.T. Isaac, 2012).

5.1.5 Encryption Technology

A possible substitute approach to public-key cryptography is Elliptic curve cryptography (ECC). Based on the elliptic curve logarithm, the required key size to gain the same level of security provided by public-key cryptographic schemes will be substantially decreased. This matter permits ECC to use much smaller key sizes to offer equivalent security as RSA (roughly one-eighth of the key size used by RSA), which in turn dramatically decreases processing overhead. Consequently, faster calculations, lower power and memory required, and bandwidth savings are features provided by ECC that are beneficial for carrying out encryption on mobile devices. System designers should investigate the probability of integrating ECC algorithms in prevailed or new mobile payment systems to harvest many of the advantages of ECC in mobile devices.

In the case of mobile payment systems based on restricted communication scenarios, Self-certified public-key strategies are a substitute security solution in which public key validation can be indirectly obtained with signature verification. In this plan, one of the involved entities has connectivity restrictions that impede communication with a certification authority for authenticating a certificate during a transaction. Alternatively, the user public key is obtained from the signature of the user secret key along with user identity and is signed by the system authority using the system secret key. Despite that, one of the open issues in all the suggested schemes is undefined expiration of this kind of certificate.

The statistical trends demonstrate that mobile payment continues to grow exponentially both in the number of mobile payment users and the number of transactions. Simultaneously, security will be of the utmost importance. The establishment and adoption of various prominent technologies will cause new challenges and opportunities to the design and execution of secure mobile payment systems today and in the future (J.T. Isaac, 2014).

5.2 Possible Scenarios of Mobile Payment Evolution

Based on the challenges mentioned previously, the mobile payment market probably develops along one of the four different directions explained below, each of which serves differently key players.

5.2.1 Wait and See

This scenario pursues the existing path; mobile carriers, financial institutions, payment suppliers and others investigate the establishment of different payment services in certain geographic markets. The restricted partnership between contrasting industries and limited scale will probably suppress services, tear apart offerings, and concentrate on niche markets. Consequently, Mobile wallets with diverse payment services like credit cards, remittances, and remote payments will not occur. Rather, each of these advantages becomes standalone services demanding the customer to initiate distinct relationships with the vendors.

Financial institutions have little motivation to enter mobile payments except if it is part of a defensive strategy. Banks and credit card companies engaged in several mobile payment trials in the United States, but they perceived little advantage to continue to largely establish the services. Financial institutions may position themselves on the sidelines until a threat shows up. Though this would probably be a mistake, as they risk not leveraging on high-speed innovations occurring on the mobile platform.

As mobile operators are experiencing stationary average revenues per user innovative solutions are paying off well. Thus, mobile operators evaluate the mobile payment a remunerative path for growth and seem to be much more motivated than the financial institutions for entering this field; However, to trigger essential revenues, it is essential to establish new payment strategies which go beyond the acquiring of digital goods such as themes, ringtone, etc. Consequently, by adding customers' retail purchases to a monthly bill the mobile operators can expand their solution by a payment platform for physical goods and services. Notwithstanding the

smartphones with NFC feature make this solution operational at the physical retail point of sales, it is necessary to establish a close collaboration between mobile phone producers and merchant to make the service practical. On the other hand, SMS-based payments are not suitable for the retail physical transaction. It may be applied more efficiently for intangible assets.

The payment instruments that benefit the most for merchants are the ones that can battle with credit and debit cards. That is, proposing more interesting transaction fees to the merchants can make the mobile operators more competitive respect to financial institutions and then bring them retail transaction revenues. There are different challenges in this way that mobile carriers should consider carefully. First, mobile operators must encourage merchants to be a part of the payment network. Otherwise the customers will not employ the service that will not be accepted by enough merchants. Second, where it is needed to credit the customer and ensure the payment and settlement to the merchant, the mobile operators must take the more financial risk. Finally, they must accept more agreement weight by the banking regulations (Deloitte, 2011).

5.2.2 Fly Solo

In this scheme, one player with remarkable market power invest for development stimulation. for instance, NTT DoComo, established a payment platform, provided the payment applications, invested in a bank, put the merchants together, and distributed subsidies to build a vigorous contactless payment to achieve competitive advantage. In order to perform over the industry boundaries, the market leader should handle essential risks and gain the required licenses. For instance, one mobile network operator can acquire a banking license or vice versa. Though it is improbable that a bank takes the lead in the market.

The financial institutions are also investigating the possibility of furnishing payment services to their current customers without the engagement of mobile network operators in order to reduce the risks. A favorable solution is to supply a microSD card containing a contactless payment system that is associated with credit or debit cards. Then the bank users can put it into their smartphone to enable it handling

contactless payments, though it misses the full functionality of NFC. On the other hand, mobile operators should invest in the payment platform, create all the units of the ecosystem alone which seems implausible because of not guaranteed pay off and intrinsic risks. Altogether this scenario is less popular (Deloitte, 2011).

5.2.3 The Buddy System

There will be an alliance between a mobile network operator and a financial institution to establish payment service in which a credit or debit card is associated with a mobile application. By doing so, the risks and benefits will be shared between both participants allowing them to determine clearly the business model. The reason can be found in better harmony and better targeting the problems. Historically, these two sectors not only have not experienced much cooperation together, but also have different expectations. Thanks to this framework they can work together to establish a big partnership. The reason behind this broad coverage of potential customers which is bigger than the overlap of the two partners' customer base, is this alliance which can provide credit cards. Then, the substitution of credit cards with a mobile phone will increase the customer value since it enhances security and is more convenient. Comparing to the Solo strategy, this scenario requires less investment because of the utilization of the current existing payment network. Upgrading the point of sales to NFC compatibility can cost the merchant up to $150 for each terminal (computerweekly.com, 2002)

It is necessary for the alliance of mobile operator financial institution to supply incentives to encourage the adoption; However, they may not subsidize completely the service. One of the incentives may be the fewer fee charges for merchants. Nonetheless, they also need to provide innovative services like location-aware coupons and customized payment application in the mobile wallet. On the other hand, it is not so obvious that how financial institutions can improve their profit, because the embedded credit card solution somehow gives the same service of the existing plastic cards while they must share their revenue with the new partner. Therefore, it is required to establish a better market offering for these kinds of partnerships.

5.2.4 Open Federation Alliance

In this scenario, mobile network operators, financial institutions, merchants, mobile device producers, chip makers, and application developers would come together on a regulated platform to establish a range of financial services on mobile devices. An open federation alliance enables all the players from various industries to reunite upon a joint vision and utilize multi-lateral advantageous business models to bring to existence the full capacity of mobile payment. A Trusted Third-Party Manager (TTPM) plays the critical role of coordinator and integrator (figure 5-1), controlling both the platform technical features and the ruling business models (SmartCardAlliance, 2006).

Figure 5-1 Open federation model (SmartCardAlliance, 2006)

Preferably, a TTPM would not probably be either a financial institution or a mobile operator. Potential TTPMs could be mobile device makers, mobile security solution suppliers, wireless technology firms. It works with engaging financial institutions and mobile operators to establish a standardized business strategy dividing risks and rewards in an appealing way and haing the ability to govern alliances and the trustworthiness to engage large banks and mobile operators. This feature is in contrast to a platform leader who provides a platform and persuades third parties to build complementary services (A. Gawer, 2002).

Currently, the entanglement of bringing together contrasting players from different sectors is intimidating. Consequently, the route to an open federation will not be straightforward. In the long run, it is probable that a mobile payment ecosystem will progress in an iterative manner. different cluster partnerships (figure 5-2) may establish a common understanding on controversial matters. These clusters may be assumed as the DNA strands of an open federation ecosystem for mobile payments (Deloitte, 2011).

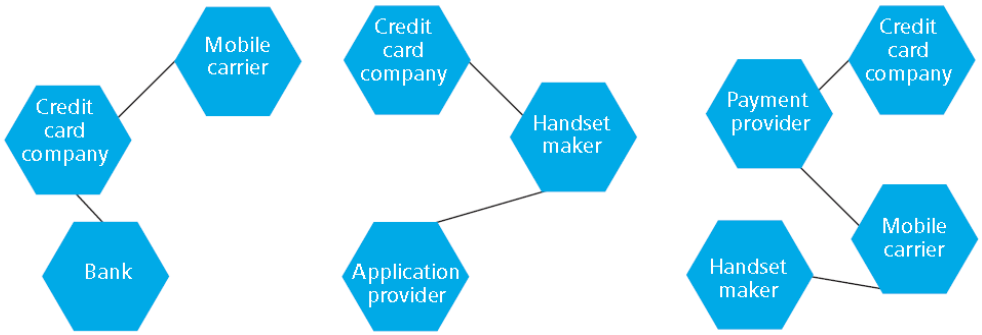

Figure 5-2 Cluster partnership, The open federation DNA strands (Deloitte, 2011)

Since an open federation can integrate payment, and merchant loyalty programs and create large volumes of transactions, the potential of NFC-enabled devices would be fully employed. A standardized platform would enable customers to select third-party applications and modify the portfolio of services. For instance, a user may utilize P2P money transfer for sending money to friends, USSD (Unstructured Supplementary Services Data) for remote purchase of transportation tickets, and NFC for executing retail payments at the physical point of sales (Deloitte, 2011).

Table 5-1 summarizes the models and their composition of winners and losers in each scenario. It can be inferred that mobile network operators can take more advantage from the mobile payment than the other players. So, probably they will take the lead in the possible future alliances in the ecosystem. On the other hand, financial institutions most probably are the biggest loser in all of the scenarios. They

may suffer less in an open federation model in which all the players leverage the most.

Table 5-1 Who wins or loses in different scenarios (Deloitte, 2011)

Scenarios	Wait and see	Buddy system	Fly solo	Open federation
MNOs	Gains by innovating disruptive models	Gains from existing payment network and generates incremental revenues	Significant risk without commensurate returns	Significant gains from large scale mobile payment deployment
Financial institutions	Loses by being on the side-lines or acts defensively when a credible threat emerges	Loses by sharing merchant revenues with carriers unless it is a niche player that expands revenue pie	Significant risk without commensurate rewards	Moderate gains from large scale mobile payment deployment
Mobile makers	Limited gain from small scale NFC deployment by the carrier	Moderate gains from NFC deployment to the larger customer base	Limited gain from a small-scale deployment	Significant gains from mass deployment of NFC and greater competition among payment instruments
Merchants	Limited gain from competition to card-based ecosystem	Gains from speeded up transactions but loses from upgrade costs of POS	Limited gains from small scale deployment	Significant gains from mass deployment of NFC
Customers	Loses because of fragmented offerings and limited availability	Gains from merchant acceptance and convenience	Limited gains from low merchant acceptance	Gains significantly because of expanded choice, merchant acceptance, and convenience

CHAPTER 6
CONCLUSION

In this chapter, the core findings of this paper will be presented and discussed. Then, the limitations of this study will be mentioned. Later, in response to the shortcoming, some solutions and future research opportunities will be listed.

Core Findings

According to the obtained results and numbers, it can be inferred that payment channels are converging more and more together, fading the rigid separation between e-commerce, mobile, and physical retail environments. Retail channels are also merging together which reinforces the usage of mobile online purchases and payments that is Mobile Commerce. Notwithstanding with the fact that conventional credit/debit cards still have a considerable share of electronic payments, the future move in the payment evolution is represented by Mobile Wallets. Numerous loyalty and reward programs are developed to incentivize the customer adoption; However, it is still to identify and clarify how the emerged platforms and mobile technologies should cooperate to maximize the stakeholder's benefits. To achieve these goals, the role of entrepreneurial ecosystem is of utmost importance. The startups can boost the electronic payment progress like a power engine by their innovative services. In the meanwhile, their performance should be monitored and evaluated by the right metrics and supported by the improvement programs and complementary sources which is the responsibility of the policy-makers.

In this study, the methodology of the census has been updated from several perspectives. These improvements refined the research boundaries to have a better understanding of the scope of the work. Not only did this generate better interpretation of the obtained numbers which resulted in an improved comprehension of the whole industry, but it also made it possible to identify more credible future trends. Consequently, it could give a better idea to both incumbents and future possible entrants of what they must be focused on for their future investments and how they must manage their developments and services.

One of the improvements was the changing name of one category from Bitcoin to Cryptocurrencies, as there were several startups that provide their services in different kinds of digital currency including Bitcoin (BTC), Ethereum (ETH), Litecoin (LTC), etc. By doing so a more general category could cover all those companies. Besides, it has been introduced a new category called as Blockchain to cover other startups related to this technology. Although it has been removed and merged with other categories later to be consistent with previous researches, the associated data is extracted and can be used in future researches.

Another modification was related to the geographical regions definition which was a bit different than previous studies. That was the extraction of the Middle East from Asia continent. This is done to enable better examination of the numbers, specifically in terms of the numbers of startups and investment funds, because a huge difference between the Middle East region and east or central Asian fast-growing countries has been recognized like India, which is rapidly becoming digitalized.

Limitations

As mentioned previously, there were two kinds of natural shortcoming in this analysis. First, the lack of data that is missing data originating the nature of Crunchbase. Second, the innate tolerance that is existed in the data.

In other words, missing data is inherent in the Crunchbase because the information on this website is provided by the startup owners and the credibility of the data is not a hundred percent guaranteed. In addition, the innate tolerance is associated with the Crunchbase search engine and the categorization of the startups. More specifically,

as witnessed during the analysis presented, on the one hand there can be some wrong entries by the creator of the data on the website, and on the other hand, these data - even wrong but matched with the perimeter of the analysis- could be fell out the results and not retrieved due to of the Crunchbase imprecise search engine.

The third shortcoming is related to the methodology is the static nature of the analysis. That is, the timeline of the data is not considered in the analysis. For instance, the time of the availability of funds is not considered. For sure, this kind of analysis required the assumption that the inserted data are precise and accurate.

The fourth shortcoming that was identified during the literature analysis, was the lack of the literature in the analysis of these two topics together. That is, mobile payment and startup. The research studies are often extremely focused on the analysis of the mobile payment side or the startup feature side; However, any organized and concentrated study work that analyses the two and interconnections and bilateral impression together could not be identified.

Recommendations for Future Research

There are recommendations that are suggested as follows. For resolving the problem of the missing data, it is strongly suggested to utilize different sources of information and match the data together, as it has been done in the case of Italian startup analysis in this study. Thanks to the Digital Innovation Observatories of Politecnico di Milano, the updated data of the Italian startups could be accessed and analyzed; Nonetheless, this could not always be as easy as it seems. Sometimes the other resources might not be available. In other cases, there may be other sources which their credibility is not verified, or even the format of the data provided is different which makes the comparison and data matching a very difficult and complicated procedure that is prone to have lots of errors. It is also recommended to some third-party independent organizations like Digital Innovation Observatory of Mobile Payment to initiate the campaign of gathering the correct, credible, complete and necessary data from the startups, and from their partners to help better understand the ecosystem and its evolution.

For the problem of the innate tolerance of the data, it is recommended to do a sort of due diligence process. That is, double checking the data inserted in the Crunchbase with other available sources like official Website, Facebook or Twitter account of the firm. However, as mentioned in the texts, most of the time the startups are in the early stages of the development and their contact pages are not updated or synchronized together, which is one the biggest faults of the young businesses because in the digital era it is of utmost importance to keep all the channels updated and coherent respect to each other. Moreover, it is also possible to perform this process via phone call which is again a very time consuming and costly process. Thus, it might not be supported by the considered and predefined budget of the research.

It is believed the methodology is a dynamic process. As there were applied some changes in the methodology of this research respect to previous year such as minor changes in the definition of the startup categories or determining the geographical areas; However, as it was said by "Lean Methodology", it is always possible to improve the process. One of the improvements that might add in the future, is the dynamic analysis of the funds and creation of the startups. Of course, this analysis has required bigger assumptions on the data, nevertheless, the results could be interesting in the sense that how this ecosystem has emerged and how it can evolve in the future.

From the research perspective, it is recommended to define some proposals, preferably practical ones, to be done in the field, and to get the practical data of how these two phenomena could influence each other. The paramount importance of the topic comes from the super dynamic and fast-changing nature of both mobile payment ecosystem and startup ecosystem. Therefore, if the relation between the two ecosystems and their bilateral influences are not analyzed in a precise and timely manner, it may cause some blockages and failures in different parts like failed strategies, not being able to adopt customers, or even obsolete and useless technologies, which further result in the defaults and diminishing of the industry. In this case, it is very recommended to initiate some funded projects supported by policymakers, mobile operators, or regulatory institutions.

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