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SCUOLA DI INGEGNERIA INDUSTRIALE
E DELL'INFORMAZIONE

The role of startups in the innovative payments' ecosystem

Master of Science in Management Engineering

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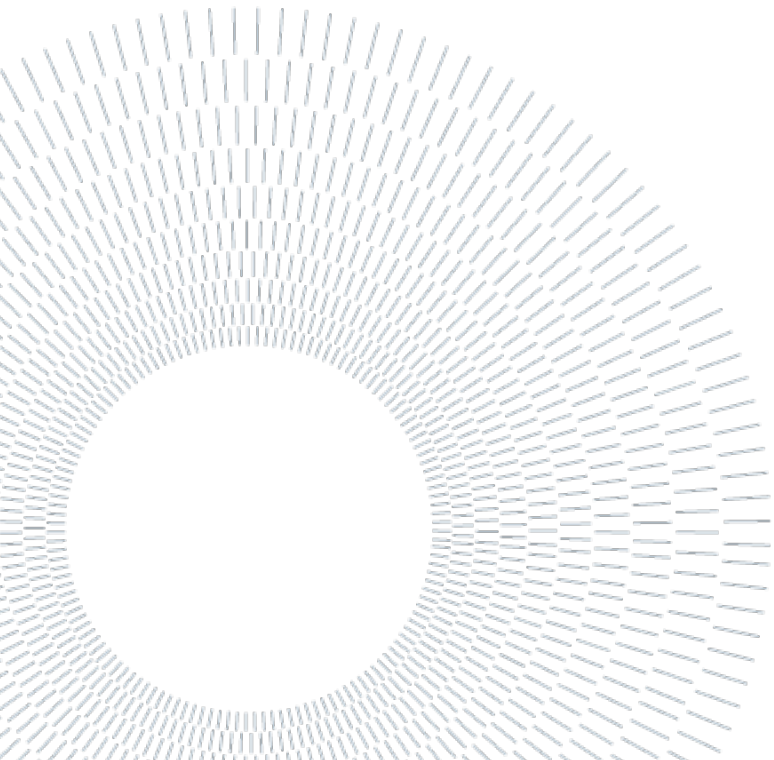

Abstract

This study is based on a census of startups focusing on innovative payments. This analysis is needed to understand the evolving world of payments, where every final customer and/or businesses choose new ways to pay over the traditional methods. Innovative payments refer to the vast part of those systems that allow a consumer to make a payment by using new technologies, such as a smartphone, a smartwatch, by waving it over the POS or by saying out loud a "command". Most of the time the big changes in the market are not brought by incumbent companies, but by startups, so it's important to consider them when analyzing the world of payments, both from an economical and academic point of view.

With the support of the Innovative Payments Observatory of Politecnico di Milano, the entire analysis was drafted into four parts.

The first one, which corresponds to Chapter 1, is based on the literature about innovative and digital payments and the ecosystem of startups. Here there are seven groups of innovative payments that are described, along with their advantages and disadvantages, in order to unveil trends that have been going on in the recent years and possible future developments. Then the focus is shifted towards startups, why they are important to study and analyze and how they can be kept alive and thrive thanks to the different ways of fundings.

The second chapter explains how all the data needed for the analysis has been obtained, which were the sources used, and the categories and subcategories in which the startups will be placed for a correct examination.

The third chapter describes all the data analyzed, which are current and possible future trends, which are the categories on which most startups focus on, the categories on which funders prefer to invest on, the geographical location of the different startups and a brief focus on Italian startups.

Finally, the last chapter sums up the entire work, explaining the main findings, the limitations emerged during the analysis, and some suggestions to keep in mind when doing a similar work for the next years.

Keywords: census, startups, innovative and digital payments.

Abstract in italiano

Questo studio si basa su un censimento delle startup focalizzate sui pagamenti innovativi, necessario per comprendere il mondo in evoluzione dei pagamenti, dove ogni cliente finale e/o azienda sceglie nuovi modi di pagare rispetto ai metodi tradizionali. I pagamenti innovativi si riferiscono alla vasta parte di quei sistemi che consentono a un consumatore di effettuare un pagamento utilizzando nuove tecnologie, come uno smartphone, uno smartwatch, muovendolo sopra il POS o pronunciando ad alta voce un "comando". Molte volte i grandi cambiamenti nel mercato non sono portati avanti dalle aziende consolidate, ma dalle startup, quindi è importante considerarle quando si analizza il mondo dei pagamenti, sia da un punto di vista economico che accademico.

Con il supporto dell'Osservatorio Innovative Payments del Politecnico di Milano, l'intera analisi è stata redatta in quattro parti.

La prima, corrispondente al capitolo 1, si basa sulla letteratura riguardante i pagamenti innovativi e digitali e l'ecosistema delle startup. Qui sono descritti sette gruppi di pagamenti innovativi, insieme ai loro vantaggi e svantaggi, al fine di rivelare le tendenze che si sono sviluppate negli ultimi anni e possibili tendenze future. Successivamente, l'attenzione si sposta sulle startup, sul perché sia importante studiarle e analizzarle, e su come queste possano essere mantenute in vita e prosperare grazie alle diverse modalità di finanziamento.

Il secondo capitolo spiega come sono stati ottenuti tutti i dati necessari per l'analisi, quali siti web sono stati utilizzati e le categorie e sottocategorie in cui saranno collocate le startup per un'analisi corretta.

Il terzo capitolo descrive tutti i dati analizzati, che comprendono le tendenze attuali e future, le categorie su cui si concentrano maggiormente la maggior parte delle startup, le categorie su cui i finanziatori preferiscono investire, la posizione geografica delle diverse startup e un breve approfondimento sulle startup italiane.

Infine, l'ultimo capitolo riassume l'intero lavoro, spiegando le conclusioni e quali sono stati i limiti incontrati durante l'analisi, fornendo inoltre alcuni suggerimenti da tenere in considerazione quando si svolgerà un lavoro simile nei prossimi anni.

Parole chiave: censimento, startups, pagamenti innovativi e digitali.

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TESI MAGISTRALE IN MANAGEMENT ENGINEERING – INGEGNERIA GESTIONALE

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1. Introduction

Innovative payments are becoming more and more part of the everyday life of every consumers, and they may not even recognize it. According to the latest Statista digital payments growth statistics (2022), in 2023, the total global digital payments transaction value is projected to reach $9.47 trillion, while the global digital payments market revenue is expected to grow 11.79% annually (CAGR) from 2023 to 2027, reaching $14.79 trillion in 2027. These data clearly show how advanced these products are becoming, and how businesses should not fall behind and exploit these new technologies.

This study is meant to be a yearly census of the international world of startups focused on innovative payments. First, a thorough literature review on the different aspects of innovative payments is done to give the study a solid background with lots of different information and data about usage and new trends around the world. Then, all the data of those startups will be analysed in order to understand all the positive and negative trends, which payment methods are used the most and where and how much these startups have been funded. At the end, a conclusion is drawn based on the results obtained and possible recommendations for future research.

A thorough study on startups can unveil different trends and tendencies that are important to understand the ever-changing payment systems around the world. They are those actors in the game that are contributing the most to the new products and services offered. Also, it's important to analyze them both from an academic and business point of view since startups have the capability to disrupt incumbent companies and they can bring innovation on the market. It's also crucial to understand how startups can take further steps in their development by receiving fundings and transition from a small company with a handful of employees to big companies with different offices around the world.

2. Literature review

Before the analysis, all the different products and services that fall in the payment system world were grouped together based on their characteristics. The main categories found were seven: Digital Wallet, Payment Acceptance, Technological Solutions, Blockchain, Sending Payments, Open Api, Other.

The first category, Digital Wallet, refers to all those payments that are made using a smartphone and/or applications. This is the most used category of payments around the world, as it was shown by multiple reports published by Statista; the highest number of users can be found in far east and China. In this last country there is a very famous application that must be mentioned, which is that of Super apps, a subcategory of the main category, which is an app where different payment services are offered. They can range from sending messages to sending money, from ordering and paying for food to paying for the monthly phone bill. The main advantages of implementing digital wallets to make payments are additional security as payments can be secured with biometric features, they are widely accepted worldwide, they help small businesses to accept different kind of payments and help them grow faster, they can be used for fast and efficient payments, and they are reliable.

The second category is Payment Acceptance and, as the name suggests, it's about developing products and services focused on accepting different kind of payments. The main trend for what regards payment acceptance is based on contactless payments, which is one of the products that are being used by millions of people in Italy and around the world. This technology doesn't involve any contact between the device and the reader: it lets the

customers tap a credit card or wave a mobile phone over the reader to make payments. The way they work is based on shortrange contactless technologies that use magnetic field induction, namely Near Field Communication (NFC), which is incorporated in many smartphones, to replace common electronic payment method (Aris et al, 2022). In this same category debit and credit cards can be found. Even though these payment methods have been around for a while, people are still used to them and use them a lot, even more than other methods. As FIS reported, during 2022 debit and credit collectively were used 49% of the time at a POS around the world.

The third category is Technological Solutions, which as the name suggests, contains all those trends based on new technological developments. The first one is based on smart objects, which refers to products that come with a particular technology that enables the users to do things that weren't possible before, like voice payments, which is a payment by using the customer's voice. This can also be done with smart home devices and smart speakers, such as Alexa and Google Home. The other trend is based on Security and Biometric. As products and technology evolve, people feel the need to feel protected and secured from a world where everything is becoming online and digital. They still choose those payment methods that are more secured, such as physical cards, and avoid online transactions as they don't want to publish their sensible information online.

The fourth category is Blockchain, an online world that has been evolving in the last 15 years, especially since 2019 as Bitcoin got the attention from most of online investors. For the sake of this study, the focus was on Cryptocurrency, a digital currency for digital transactions. The only problem is that cryptocurrencies have been used mostly as an investment tool and not as an everyday-payment tool. In 2022 cryptocurrencies accounted for less than 0.2% of total global e-commerce value (FIS, 2023). That is because merchants and businesses still don't have a way to accept those kinds of payments, but they are moving towards the right direction.

The fifth category is Sending Payments. One of the most important trends is Cross-border payments, which refers to sending money abroad to another country, either for relatives or to pay for products and services which only accept local money. Cross-border payments are now receiving more attention than before. An important catalyst has been the ambitious G20 program to improve these payments (Claussen and Pedersen, 2022).

The sixth category is Open API, which group together trends relative to account-to-account payments. Open Banking is one of those trends, it started in the UK and it enables customers and small businesses to share their data securely with other banks and third parties, allowing them to compare products based on their own requirements and to manage their accounts without having to use their banks. Another trend is Open API, which enable third party developers to build innovative apps, deliver enhanced capabilities in the marketplace and provide better omnichannel customer experience. A concept related to Open API is the Second Payment Service Directive or PSD2, which will give consumers more and better choice in the EU retail payment market. At the same time, it will introduce higher security standards for online payments. This will make consumers more confident when buying online.

The last category is called Other, as it groups together all those subcategories and trends that do not fit well into the other groups. One of the most important trends in here is Buy Now Pay Later, also called BNPL. It allows customers to take possession of their purchase immediately, with or without a down payment (Arisandy et al, 2023). Another trend in the Other group is based on wearable payments, which has to do with wearable devices, such as smartwatches, on which payments can be made thanks to Field Communications technology.

After an in-depth analysis of the seven innovative payments categories, it's important to focus on who are those actors that can bring the change in the market: startups. They play a pivotal role in driving innovation, economic

growth, and technological advancement in the contemporary business landscape. These entrepreneurial ventures, often characterized by their innovative ideas, disruptive technologies, and the ambition of their founders, have a significant impact on various industries. Startups have the agility to swiftly adapt to changing market dynamics and experiment with new solutions. They are free of the bureaucratic constraints that often fall on larger corporations, enabling them to pivot rapidly and redefine their business models (Blank, 2013). Startups are also significant drivers of job creation, generating employment opportunities and stimulating competition in the market. They are essential for economic growth and often contribute to regional innovation clusters (Feldman et al., 2005).

In today's rapidly evolving digital landscape, startups focusing on innovative payments have emerged as pivotal players in the global economy. The study of startups in the world of innovative payments is very important, not only for the academic community but also for governments, businesses, and financial institutions. By exploring the dynamics, challenges, and potential of these startups, it is possible to sought insights into the future of finance and the broader implications of this digital revolution.

This transition prioritizes user convenience, enhances security measures, and extends the accessibility of financial services to previously underserved populations (Gupta et al., 2020). Thus, the study of these startups offers valuable insights into the social, economic, and political dimensions of the evolving financial landscape. For the academic community, the study of startups focusing on innovative payments is an intellectually enriching topic. It challenges researchers to explore topics ranging from consumer behavior and payment adoption patterns to the intricacies of blockchain technology and the governance of decentralized financial systems (Choudhury et al., 2019). From a practical perspective, research in this field holds immense relevance for businesses, financial institutions, and the startups themselves. Understanding the dynamics of digital payments is essential for staying competitive in an era where traditional banking models are under threat from innovative fintech disruptors.

The COVID 19 pandemic reshaped the landscape of financial transactions and accelerated the development of innovative payment solutions by startups. This crisis acted as a catalyst, forcing fintech startups to find new ways of conducting transactions and reimagining traditional payment methods. The pandemic underlined the need for contactless and digital payment options while highlighting the limitations of existing systems.

As it was underlined, startups can bring innovation and new technologies on the market, but before they reach the final customer, they must gather the necessary funds to stay alive. Their journey encompasses several distinct stages, each representing its own challenges, opportunities, and different objectives. Their development is divided into five different stages: pre seed and seed stage (concept and product introduction), Round A (growth), Round B and Expansion (maturity). In each stage there are different sources of funders which are savings, Friends Family and Fools (FFF), crowdfunding, grants, Business Angels, venture capitalists, private equity, and stock exchange market. In each stage the sizes of fundings varies.

3. Methodology

The primary source of information is the Crunchbase website, a platform where founders can share their information. In this website only what they shared can be found, which is a limit for this study, since important information was missing. To narrow down the range of interesting companies, some tags and constraints have been used, such as companies founded in the last 5 years, companies funded at least once in the last two years, any companies that are in the industries of mobile payments and transaction processing and that contain the word “payment” in their description. After obtaining the list of all

startups, which were 2677, a careful analysis was conducted to understand if each startup was in scope for this study or out of scope. Then, all the in-scope startups, which were 1112, have been placed in one of the seven categories previously mentioned, and in a specific subcategory. The subcategory for Digital Wallet were All-in-one platform, Corporate cards, Challenger Banks, Cashback and rewards, Other. For Payment Acceptance they are Acceptance, Payment Gateways, Mobile Ordering, Recurring Payments, Mobil smart and soft POS, Smart Shop, Collection of invoices. For Technological Solutions they are Cashflow Management, Infrastructure, Security & Privacy, Marketplace. For Blockchain they are Wallet, Acceptance, Other. For Sending Payments they are Managing and payment of invoices, International payments. For Open API they are Account Information Service Provider (AISP), License as a service (LAAS), Open Banking Platform, Payment Information Service Provider (PISP), Card Issuer Service Provider (CISP). For Other they are BNPL, Loans and other financial services, Digital Identity, Donations, Wearables. After placing them into the right subcategory, it was necessary to understand which were their customers. The main choices were B2B, B2C, B2B & B2C, B2B2C. Another analysis was made based on their HQ location so that they could be placed in the right country and continent.

4. Analysis and Results

The category with most startups is Digital Wallet, with 232 startups and 21% of the total, followed by Payment acceptance with 214 startups and 19% of the total and Technological Solutions with 179 startups and 16% of the total. A deeper analysis was conducted on each category to understand the reasons why they were at a certain place, and on each subcategory another important analysis to make was based on the funding received. The total amount of fundings received is 19.5 billion $. Despite Digital Wallet being the category with most startups, the one which received most funds is Other (with 166 startups), with 5.6 billion $ and 29% of the total followed by Digital Wallet with 4.9 billion $ and 25% of the total and Technological solutions with 3.2 billion $ and 16% of the total. This is because the subcategory BNPL received 3.8 billion $. The second subcategory with most fundings is Corporate Cards with 2.9 billion $ and the third is Cashflow management with 2.2 billion $. Other still holds the first place if the focus is shifted towards the average funding received, where Other has 39 million$, followed by Digital Wallet with 26 million $ and Technological Solutions with 22 million $. The subcategories with the highest average fundings are CISP with 92 million $, Corporate Cards with 90 million $ and BNPL with 75 million $ Startups focusing on CISP are only 5 in the entire world; if this number was higher, the Open API category would be at a higher place for most fundings and average fundings received. The three startups with the highest funds received are Ramp, focusing on Corporate cards and receiving 1.36 billion $, Tabby focusing on BNPL with 740 million $ and Scalapay, an Italian startup focusing on BNPL with 727 million $.

After analyzing the fundings, the focus was shifted towards the startups target, which is who their customers are. 537 startups (48% of the total) developed products and services for B2B, while 360 for B2C (32%), 127 for B2B2C (11%) and 88 (8%) for B2B & B2C. Most of the startups (80%) decided to focus on a single group of customers as it was easier to develop products and services for one group at a time. B2B startups also received most of the fundings, overo 10 billion € which is 54% of the total, while B2C received 3.9 billion $ which is 20% of the total. Interestingly, B2B & B2C have the highest average fundings received, with 41 million $, while B2B is at the second place with 23 million $, B2B2C at the third place with 20 million $ and B2C is at the last place with 13 million $.....

The last general analysis was conducted on the geographical trends, where it was discovered that North America has the most startups, with 405, all thanks to the USA, which is the country with the most startups, 367, 34% of the total

startups in the world. At the second place comes Europe with 204 startups and at the third place is Asia with 204. It's important to underline the fact that the Crunchbase website is American, meaning that the Asian countries probably don't even know of its existence or just don't use it. In fact, it appeared that the number of Chinese startups is only 2, which is an absurdly low number for a country where 12.000 startups are created every day. The second country with most startups is the UK with 91 (8% of the total) and India with 53 (5% of the total). Another important fact to underline is that the list of startups was extracted from the Crunchbase website in July 2023, meaning that half of the year wasn't considered for the number of startups created in those 6 months. Also, not all startup's owners are waiting to create their startups just to publish their info on Crunchbase. Many owners wait months before revealing their information. To make a very precise analysis, it should be made during the first months of the new year, since many startups publish how many fundings they received only at the end of the year, along with their balance sheets. For what concerns the fundings based on territories, North America takes the lead with 9.6 billion $ (49% of the total), followed by Asia with 4 billion $ (21%), Europe with 2.9 billion $ (15%), South America with 2.3 billion $ (12%). In the last places are Africa and Oceania with 208 and 266 million $ (both 1% of the total). North America still has taken the first place for the continent with the highest average fundings received with 28.3 million $, but the second place is taken by South America, with an average of 28.2 million $. In Mexico alone, startups received 1.3 billion $, with an average funding of 64 million $ per startup. The country with the highest average fundings received is Italy, with 105 million $, all thanks to Scalapay, the third startup with most fundings in the world.

A smaller and deeper focus was given to Italy, as they only had 7 startups on Crunchbase. The preferred categories seem to be Other and Payment Acceptance. Given such a low number of startups for an advanced country, more research were conducted for this country and it was revealed that, in fact, there are many more out there that did not register on Crunchbase, showing that Crunchbase alone cannot be "trusted" for a full and precise analysis on this topic.

5. Conclusion

In recent years, new startups have been growing steadily, showing a strong interest in new ways of paying for products and services. Based on the findings, it seems that these innovative payment methods are becoming a regular part of how people spend money every day, making the distinction between online and offline payments less relevant. While traditional cards are still widely used, mobile wallets are catching up and even leading the way in some countries. Some companies are finding creative ways to get people to join the trend of Digital Wallets which has the most startups (232), like loyalty programs and all-in-one platforms for tasks such as ordering a taxi or paying bills. These became popular, especially after Covid-19, as people looked for ways to make purchases without exposing themselves too much. As consumers explore new ways to make payments, startups are developing advanced systems to help businesses accept one-time or recurring payments. Sending money abroad or paying for products in a different currency is also gaining attention. To make and accept these payments, the technology behind the services must change, and startups are offering solutions for cash flow management and payment infrastructures. In the financial services sector, funding has been directed towards startups focusing on "Buy Now Pay Later," loans, and other financial services, accounting for over 29% of the total. Consumers appreciate these financial services because they allow for better management of their finances, avoiding the stress of significant payments right after a big purchase. Another positive development is in open banking, offering new services based on data. On a different note, the relatively new but advanced blockchain world is making its way

into everyday life, with startups trying to implement it into payments to make life easier. The world of innovative payments is getting more advanced by the seconds and to keep up with such speed it's important to have all parties involved and create a platform of collaboration. This census can be the basis for future studies and the starting point for an analysis based on more years.

There a few limitations that must be considered when reading this study. First, the fact that all data were extrapolated in July 2023, making that year not useful for this study (less than 20 startups seem to be born in 2023). Also, founders tend to wait some time before publishing info about their startups. Furthermore, on Crunchbase not all the important information about companies could be found, leaving some of the work up to the researchers by looking for the startups' websites and other information of the startups, which were unavailable in some unfortunate cases.
Still on Crunchbase, understanding which startups can be considered "in scope" and which "out of scope" was the part that took most of the time.
Another limitation is brought up by China and other Asian countries. Not having any info on them can alter the results of this study.
The last limitation, found during the writing of the literature review, was the missing information related to both startups and innovative payments. There are a lot of scientific documents related to both topics, but separately.
In order to make the analysis more complete and accurate, it's suggested to wait one full year and make the research about the six previous years, leaving out the year that just passed. Another suggestion is to not base the entire data set only on Crunchbase.

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1 Literature review

In the following chapter, an intensive literature review on innovative payments will be presented. Furthermore, different aspects of the startups' ecosystem will be described and analyzed.

In the following paragraphs, a deep and thorough analysis based on innovative payments categories will be presented, along with examples, data and observations.

1.1. Digital Payments

Digital payments are a large sector which includes different kinds of payments. Usually, digital payments are referred to all those payments which are not based on cash, checks and credit transfers. They represent an important shift in the way individuals and businesses engage in transactions. These payments, characterized by their reliance on electronic channels, have transformed the way people exchange value in the digital age. The acceleration of digital technologies has not only facilitated but also necessitated the development of increasingly sophisticated digital payment systems (Choudhury et al., 2019). This evolution has given rise to a variety of payment methods and mechanisms, including mobile wallets, contactless cards, cryptocurrency transactions and so many more, each of which offers a unique number of features and implications for the world of finance (Kim et al., 2017). These technologies are not merely altering the mode of payment; they are profoundly reshaping the financial services landscape by prioritizing user convenience, enhancing security measures, and expanding financial accessibility (Gupta et al., 2020).

In this rapidly evolving financial ecosystem, understanding the multifaceted nature of digital payments is a necessity for a wide range of stakeholders. Businesses must shift their focus on consumer preferences and integrate these digital methods into their operations. Financial institutions find themselves navigating a dynamic environment, striving to remain competitive and secure in an era where traditional banking models are under threat. In order to grasp the importance and magnitude of this change, it's

important to also analyze the startups which are developing new services and products that are focused on the digital payment world.

This thesis aims to provide a comprehensive examination of digital payments, covering their various forms, exploring their impacts, and analyzing the challenges they present. Then, after an analysis on the different payment methods, the focus will be shifted towards startups, why they are important for this topic, how they can change the world of payments and how they can get funds. An analysis on the trends will be carried out to understand which payment system is the most used globally and in different continents, which received the most funds etc….

1.1.1. Digital payments around the world

The use of digital payments in italy has been increasing in the last 4 years, as the Innovative Payments Observatory of Politecnico di Milano has announced during the 2023 conference "Innovative Payments: don't look back", going from 29% of the total consumption in the country in 2019 to 40% in 2022. Although there were no incentive measures to help spread the use of digital payments, this sector kept a steady increase, despite the general reduction of total spending because of COVID 19 (Innovative Payments Observatory of Politecnico di Milano, 2023).

According to the latest Statista digital payments growth statistics (2022), in 2023, the total global digital payments transaction value is projected to reach $9.47 trillion, while the global digital payments market revenue is expected to grow 11.79% annually (CAGR) from 2023 to 2027, reaching $14.79 trillion in 2027. In 2023, the total U.S. digital payments transaction value is projected to reach $2.04 trillion, and with a 14.66% annual growth it is expected to reach $3.53 trillion by 2027. In 2023, the total China digital payments transaction value is projected to reach $3.85 trillion, and with an annual growth of 7.80% it is expected to reach $5.20 trillion by 2027. In 2023, the total Europe's digital payments transaction value is projected to reach $1.795 trillion, and with an annual growth of 13.64% it is expected to reach $2.993 trillion by 2027. In 2023, in the Italian region the total digital payment transaction value is projected to reach $117 billion, and with an annual growth of 16.67% it is expected to reach $218 billion by 2027 (Statista, 2023).

According to World Bank Group global digital payments statistics (2021), 64% of adults worldwide now make/receive digital payments. In developed countries, 95% of adults are using digital payments compared to 57% of adults in developing countries. According to the latest McKinsey & Co U.S. digital payments statistics (2022), 89% of

Americans are now using digital payments. Also, Americans who are using two or more forms of digital payments have grown from 51% in 2021 to 62% in 2022 (McKinsey, 2023).

In a similar survey by Statista, it's shown that the most used digital payment system in the world is mobile wallet, also called digital wallet, which is a wallet that can be kept in a mobile phone along with credit and debit cards, which will be discussed later in this thesis. The highest number of users can be found in far east and China, while in the USA, the most used payment method is credit cards for any kind of purchase, but for what concerns e-commerce digital wallets could soon take over physical cards. In Europe, the most used digital payments were still mobile wallets, where PayPal was the preferred brand (Statista, 2023). In a survey by FIS they show that the digital wallet is the most used payment method for e-commerce (29%), while at POS the most used are debit cards (42%), cash (22%), credit card (21%) and finally digital wallet (10%) (FIS, 2023).

All these trends and more can be analyzed by focusing on startups. A thorough study on startups can unveil different trends and tendencies that are important to understand the ever-changing payment systems around the world. They are those actors in the game that are contributing the most to the new products and services offered. Also, it's important to analyze them both from an academic and business point of view since startups have the capability to disrupt incumbent companies and they can bring innovation on the market. It's also crucial to understand how startups can take further steps in their development by receiving fundings and transition from a small company with a handful of employees to big companies with different offices around the world.

But before analyzing startups, all the different products and services that fall in the payment system world must be grouped together based on their characteristics, so that the startups can be put in those same groups for the final analysis of this thesis.

After a thorough procedure of analyzing the characteristics of each single product, which will be explained as each single macro category is going to be examined through the following chapter, 7 macro categories were found, each with different micro categories, as shown ins Figure 1.

The first category that will be studied is called "Digital Wallet" and here there are all those payments that are made through a digital or mobile wallet, and they can be done either in store or outside a store. There are also included startups which develops superapps that are very popular especially in China. The second category is called

"Payment acceptance", which refers to all those systems for the acceptance of different kinds of transactions taking place both offline and online, made through different payment methods. The third category is called "technological solutions" which refers to the solutions that supports the payment procedures in different parts of the payment process, such as security and privacy or cashflow management. The fourth category is called "blockchain" and it refers to all payment solutions that are able to function thanks to the blockchain system underneath, such as wallets and payment acceptance systems. The fifth category is "sending payments", which refers to all those solutions for managing payments for companies and sending payments abroad. The sixth category is called "Open API" and it includes services such as account-to account payments and open banking platforms. The last category to be studied is "Other", which includes payment systems that are not included in the previous groups, such as Buy Now Pay Later solutions, digital identity and wearable payments.

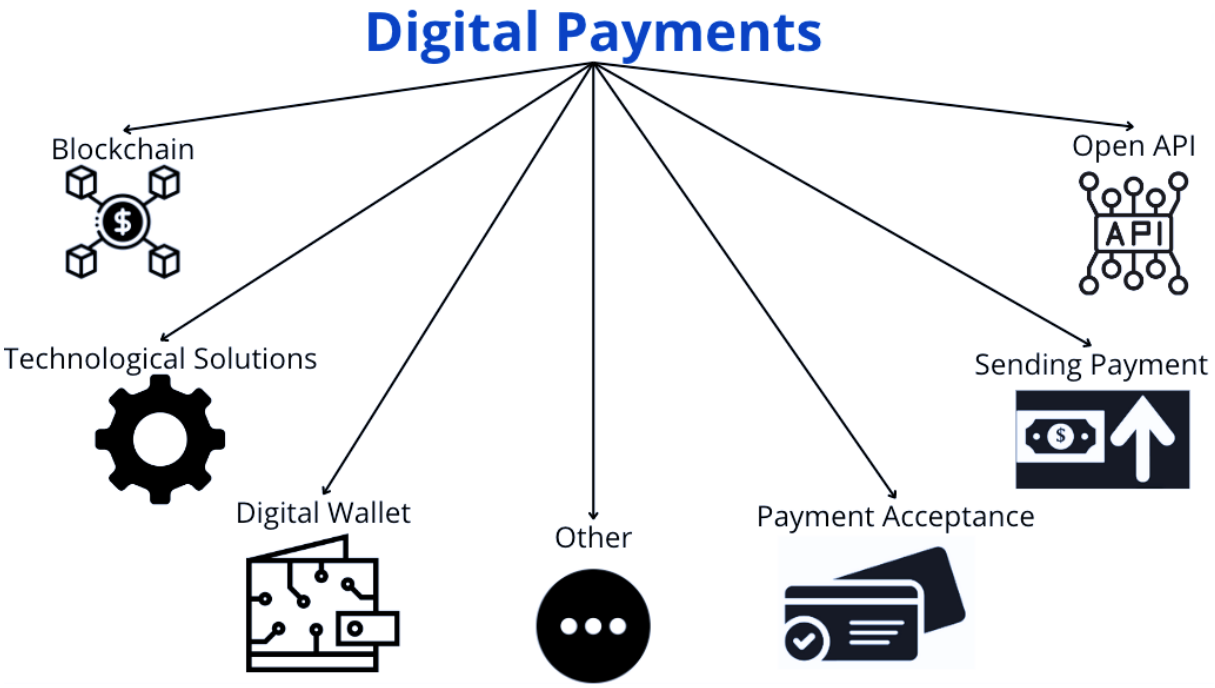

Figure 1.1 - The seven macro categories

1.2. Innovative Payments Categories

1.2.1. Digital Wallet

Digital wallet is a macro-category which includes all those payments that can be made online, without the needs of physical cards, for example. They are also the ones which are showing the highest degree of growth in the latest years. An example of digital wallets are all-in-one platforms which offers different services to the final consumers, such as online and offline payments.

The most important and interesting example of digital wallets are Mobile wallets, which are mainly used through mobile devices, such as smartphones. A mobile wallet is the mobile declination of the e-wallet or electronic wallet (Risi, 2018). They refer to apps and software that allow customers to purchase goods and services securely from their mobile phones using their debit and credit card details stored digitally. According to forecasts and studies made by TMR, the mobile wallet market size is expected to hit $16.2 trillion by 2031, as adoption in rural areas across the world increases. The popularity of mobile wallets can be mainly attributed to their ease of use: users only need to download a mobile app and supply their bank account details. After identity verification, users can make purchases right away, both in-person or online. Other benefits of using mobile wallets are its convenience, because it enables faster and contactless purchases which take less time compared to paying by cash or card, fraud reduction because payment information stored in mobile wallets are tokenized (transactions are also covered by the same security and privacy protections as a physical card), and the possibility to add loyalty cards which deliver added value both for consumers and merchants as well.

Another factor which was underlined by Wong and Kwok is that the use of mobile wallets has increased significantly as COVID-19 spread rapidly during the first semester of 2020. For example, during the pandemic, the Malaysian government has encouraged the public to adopt mobile wallets for the payment of purchases as they are regarded as far safer than paying by cash. Since they offer contactless payments, using them may protect consumers against COVID-19 and other viruses that can be transmitted by touch (Teng and Kong, 2021).

A mobile wallet is a medium or application that allows users to make monetary transactions via smartphones or websites. Money can also be loaded into a wallet from an individual's bank account using an electronic funds transfer (EFT) or debit card, or from an individual's credit card (Bangla and Sancheti, 2018). Additionally, a mobile

wallet mobile application provides access to food deliveries, bill payments, ride-hailing, and online purchases linked to merchants. This financial innovation has resulted in monetary transactions shifting away from the traditional use of cash. They have rapidly gained user acceptance given the ease with which payments can be transacted via mobile applications (Cabanillas et al, 2014). Mobile wallets are widely accepted in Malaysia due to the increasing preference for cashless transactions that offer consumers convenience and efficiency. Cash payments at physical stores are gradually being replaced by scanning a QR code using a smartphone linked to an e-wallet (Teng and Kong, 2021).

The main aspects to analyze to understand the shift of the preference towards mobile wallets reside in trustworthiness, reliability, and perceived health risks, which will be analyzed below.

Trust is a fundamental element that facilitates the success of interpersonal relations and transactions, as its central role is to regulate social interactions (Egea et al, 2011). Trust in technology focuses on "what it is about technology that makes the technology itself trustworthy, irrespective of the people and human structures surrounding the technology (Mcknight et al, 2011)." According to Yang et al., trust in innovation is based on information supplied by service providers. The extent to which trust is built with users significantly influences acceptance intention. Lu et al. examined mobile wallet use in China, demonstrating that trust influences a user's intention to adopt it, whereby users who regard a payment system as trustworthy display a higher level of intention to use it (Lu et al, 2011). On the other hand, it's easy to see that a lack of trust could lead to low engagement. According to Becerra and Korgaonkar, users tend to avoid online transactions that demonstrate low trustworthiness. Liébana-Cabanillas et al. found that tech-savvy users are more likely to exhibit higher trust in online applications, so they are more likely to adopt mobile wallets and trust the payment system. Therefore, it can be confirmed that there is a positive relationship between the trustworthiness of a mobile wallet and the intention to use it (Wong and Kwok, 2022).

Reliability refers to the expectation that a form of technology will operate with consistency and certainty (Mcknight et al, 2011). In the context of mobile wallet use, Liébana-Cabanillas et al. found that a lack of reliability was a significant factor preventing its adoption in Spain. Ramadan and Aita showed that mobile payment reliability has a positive relationship with trustworthiness, affecting users' intentions to adopt those wallets. As such, the reliability and trustworthiness of a mobile payment system are interrelated. Therefore, there is a positive relationship between

the reliability of mobile wallet and its trustworthiness and the intention to use it (Wong and Kwok, 2022).

Angelakis et al. found that cash used in traditional cash payments were highly likely to be contaminated, with up to 88% of cash being contaminated with microorganisms due to their circulation. The use of cash is one of the easiest ways through which diseases can spread, as influenza viruses can survive on cash and thereafter be transferred to other objects or their surroundings, which can create a public health risk (Angelakis et al, 2011; Thomas et al, 2008). Although cash can be regarded as a medium through which diseases are transmitted, few studies have analyzed the relationship between the perceived health risks of using mobile wallet applications compared to using cash, and how this might affect the intention to use them. Hence, there is a positive relationship between health risk and the use of a mobile wallet (Wong and Kwok, 2022).

A survey made by FIS underlines what are the most favorite mobile wallets in Europe and around the world. PayPal is the leading wallet in Belgium, France, Germany, Italy, Spain, and the U.K., with significant share in most other European markets. Other international brands, such as Apple Pay, Google Wallet and Amazon Pay, are also popular in Europe, as are many local payment apps, including MobilePay in Denmark, Vipps in Norway, BANCOMAT Pay in Italy and Lydia in France. Latin America has seen Mercado Pago (the payment arm of LATAM's largest e-commerce marketplace, Mercado Libre) revolutionize digital payments across the region. However, local digital wallets are emerging among the leaders in their respective markets. These include MACH Pay in Chile, PicPay in Brazil, and Nequi and RappiPay in Colombia. North America's credit and debit card markets are increasingly intermediated by a few major digital wallet brands. These initially were PayPal, Google Pay and Apple Pay, but challengers as Shop Pay (Shopify's checkout solution) and Cash App Pay (recently becoming an open loop wallet) have joined the field.

FIS also found out that China is the leading country for the most user of mobile wallets. Over the last five years though, the rest of Asia and Pacific have been catching up to China, where mobile wallets' share of transaction value at POS grew more than six times (FIS, 2023).

In Italy mobile wallets remained the leading payment method online in 2022, channeling 35% of e-com transaction value, while they remain low at 13% for POS transactions, behind credit and debit cards. In addition to global brands like Apple

Pay, Google Wallet and PayPal, PostePay which is the wallet for the widely used prepaid cards in Italy is a popular option. Wallets are also gaining popularity at POS, jumping from 10% of POS transaction value in 2021 to 13% in 2022 (FIS, 2023).

A similar concept which can be applied to mobile wallets is the implementation of a system to keep identity cards and similar documents. The mobile "repository" wallet can be used to keep in a mobile phone not only debit and credit cards, but useful information and documents as well. It can be used to keep loyalty cards, passwords, train and airplane tickets, identity cards, driver's license, and so on. The "Digital Identity" wallet, highly pushed at the European level by the eIDAS regulation, shift the wallet's focus on the identity theme. The eIDAS Regulations sets out rules for European territories trust services and establishes a legal framework for the provision and effect of electronic signatures, electronic seals, electronic time stamps, electronic documents, electronic registered delivery services and certificate services for website authentication.

A similar concept to mobile wallets are the **super apps**. A super-app is a mobile application that provides multiple services including payment and financial transaction processing, effectively becoming an all-encompassing self-contained commerce and communication online platform that embraces many aspects of personal and commercial life. In other words, as Mark Beresford says, a super app is a single app that does almost everything – from buying an evening takeaway meal to hailing a taxi, chatting with friends, arranging a loan, and even booking a restaurant or cinema tickets (The Paypers, 2022). A super app should be made by looking at hyperlocal problems in the region where it is being developed and all these problems should have a solution that is incorporated in the app, or at least it should reduce the friction. These super apps can deliver packages of digital services that users need. Financial services are one of the most important systems on which these kinds of apps are building their ecosystems. The Chinese apps Alipay and WeChat are leading the competition, and they have an estimated user base of over a billion users each. In fact, 73% of all the super apps are developed and used in Asia (Innovative Payments Observatory of Politecnico di Milano, 2023).

Though just a single place, super apps act as one-stop shops for all their users' needs. Any independent business can build its digital presence on these super apps, having access to a bigger user database. The main problem with super apps is that in the West, there are rules and regulations around the privacy of personal data that have created a lot of complexities for super app aspiring companies, leading to a limited number of super apps founded in the West.

Super apps' developers are already looking at the future and how they could increase the usage of their app, or simply increasing the number of services available. Artificial Intelligence-powered financial assistants that can offer personalization and budget automation for consumers will be one of the services available in the future. For the merchant, there will be a greater ability to target consumers through AI-driven data analytics, allowing them to improve conversion rates because products will be pre-matched to consumers that want to buy them.

Other changes will be the combinations of a wide range of payments, banking, credit, investment, and insurance products in a single platform, allowing users to store important documents and access credit cards, bank details, biometric information, and even medical records on their smartphones, creating not a super app but a super wallet (The Paypers, 2022).

These applications of digital wallets that were just described wouldn't be useful it it wasn't for a specific concept, which si the founding base for this macro-category: **mobile payments.**

Mobile payments are payments for products and services with a mobile device (such as a mobile phone, smart-phone, or Personal Digital Assistant) by taking advantage of wireless and other communication technologies (such as mobile telecommunications networks, or proximity technologies). In the list of mobile payments there are "remote" payments (not physically close) and "proximity" payments. Especially for proximity payments, there are a lot of technologies that are being used today. One of the most used is Near Field Communication, also known as NFC, which exploits the same technology used in contactless credit and debit cards, meaning that it can be accepted by any POS already on the market. Other similar solutions are based on the payments through QR codes or geolocation associated to the phone used. These technologies are being used more every day and they are challenging the world of payment acceptance.

Until 2023, more than 67 billion $ have been spent in the global mobile payment market (Statista, 2021). In China, mobile payments already fostered themselves as established payment mean much more than in Europe. Social messaging services offer payment services like Alipay and WeChat Pay which cover all the three designated mobile payment purposes and count 555.6 million users, of which have conducted mobile POS payments in 2021 with an average transaction value of $ 2,060 per user and year (Statista, 2021b).

In 2022, 1.5 billion people have used their smartphone to complete a transaction in store, for a total of 2860 billions of dollars, with an increase of 13% compared to 2021.

Asia alone though, has the biggest slice of the pay. In fact, China has spent over 1560 billions of dollars, which is the equivalent of 55% of the total mobile payment transactions in the world (Statista, 2023). In 2022, 39% of Chinese people have used at least once their mobile phone to pay, while this percentage is 18 in the USA and 20 in the whole world. The main reason for this high percentage in the Chinese area can be found in mainly two super apps, which will be discussed later in this paper. They are Alipay and WeChat, which have many different applications and services in only one singe app and they are very popular among the Chinese population (Statista, 2023).

A research made by the Innovative Payments Observatory of Politecnico di Milano found out that 40% of the Italian purchases has been paid by using digital payments, and 15% of the Italian population often use a mobile payment solution to make transactions (Innovative Payments Observatory of Politecnico di Milano, 2023).

Where mobile payment systems have brought new opportunities for merchants and customers, they have also exposed them to new risks regarding privacy and security issues. One of the main problems to be solved concerns the acceptance of this new type of services and the possible strategies to achieve a high level of satisfaction. This question is particularly relevant in the Italian context, since Italy has the highest penetration of smartphones and active SIM cards, along with a medium-low level of use of electronic payment instruments, compared to the other European countries (Ceipidor et al., 2012). For a prosperous future of mobile payment market, mobile phones manufacturers, telecommunication companies and payment industry need to collaborate with each other so that a platform can be developed ensuring the most secure environment for online payment transactions. However, it is believed that mobile payment systems have

the potential to tackle all of the major security and privacy concerns related to this industry.

The adoption of mobile payments affords several advantages for both consumers and businesses, including:

- Additional security. The adoption of mobile payments offers not only convenience but also an array of security advantages for both consumers and businesses. The most obvious one is that mobile phones allow consumers to not carry cash and credit cards, which lessens the possibility of these items being stolen or lost during daily activities.
  One of the primary security benefits of mobile payments is the advanced authentication methods they employ. In contrast to traditional methods like

credit cards, mobile payment apps often require multifactor authentication. This may include a password or PIN, their mobile device, and biometric data like fingerprints or facial recognition. These three things significantly reduce the risk of unauthorized access (Wang et al., 2017).

Mobile payment transactions often use a technology called tokenization, which replaces sensitive data like card numbers with a unique token. This ensures that even if a hacker intercepts the transaction, they won't have access to the user's actual financial information. This added layer of security minimizes the risk of data breaches and fraud (Van Heerde et al., 2019).

Mobile payment apps empower users with real-time transaction alerts. This means that every time a transaction occurs, the user receives an immediate notification on their mobile device. Unusual transactions can then be flagged and reversed, and the app will send a notification to the owner asking them if the purchase is being made by them or not, so that they have the chance to stop the process (Ivanova et al., 2019).

The transmission of payment data via mobile apps is fortified with strong encryption protocols. This means that the data is scrambled during transmission and can only be unscrambled by the intended receiver. It significantly reduces the risk of intruders monitoring during data transmission.

- Widely accepted. Now mobile payments are accepted widely by many retailers, and several are adding this technology fast. Customers can easily keep track of their spending as digital wallets integrate into mobile apps and software. Retailers can issue electronic receipts that also help customers track their expenditures. Customers can quickly complete transactions on the go with mobile payment solutions for an array of services, including electricity, water, and Wi-Fi bill payments, buying groceries, tickets for flights, trains, and movies.
- Easier payments for small businesses. P2P payments are not only applicable for splitting bills between friends and family. Small businesses can also use the P2P ecosystem to receive payments for goods and services. These businesses can create a special QR code and post it on their social media channels or share it via mobile phone with their consumers to enable one-time payments, which can help them to setup payments that will reduce time and will acquire new customers thanks to this advanced technology.

- Speed & efficiency. The payments industry is rapidly changing. Consumers and businesses can benefit from the seamless, efficient transactions that mobile payments enable.
  Payments are possible with a simple click, tap, or swipe. Businesses also never have to worry about tending loose change, as transactions are always exact. Also, mobile payment apps can be integrated with financial trackers, allowing for better financial management and record every transaction and understand possible trends in the market where they are.
- Convenience. Convenience is a major benefit of mobile payment services. Mobile payments are one of the most convenient ways to pay for goods and services. With the advancement of technology, mobile phones have become one of the most essential devices, an everyday companion used for everything, from checking social media accounts to communicating with friends. Customers widely use smartphones for online shopping and ordering food, therefore adding a payment method makes a simple mobile phone even more convenient for customers. Mobile payments also enable the possibility to send and receive person-to-person payments digitally.
- Facilitates the Unbanked. Mobile apps have made it easier for individuals, especially those who were previously unbanked, to participate in the economy. These apps allow users to open accounts and access financial services from their smartphones, without the need of a traditional bank account or going to a physical bank to get the services needed.
- Promotes Cashless Transactions. Mobile payment apps have been playing a significant role in promoting cashless transactions, especially after the pandemic. With their increasing popularity, consumers are becoming more comfortable with using digital payment methods, which has helped to reduce the reliance on cash.
- Improves Customer Experience. Mobile payment apps have helped to improve the overall customer experience when it comes to financial services. With the ability to complete transactions quickly and easily, and with enhanced security measures in place, these apps helped to make banking and financial services more user-friendly and accessible for all.

1.2.2. Payment acceptance

Another important aspect to analyze is the way payments acceptance has changed in the latest years. Before, when paying for a meal at the restaurant, the customer had to go to the counter and pay with their cards or cash. Now they can pay by also scanning a QR code placed at each table, or the waiter can come to the table with a mobile POS.

When talking about payment acceptance, the first thing that comes to mind, along with accepting cash and bank checks, is POS. They can be found everywhere, all over the world, and lately governments have been implementing new laws to fine all those merchants who do not accept payment contactless payments.

As the name suggests, this technology doesn't involve any contact between the device and the reader: it lets the customers tap a credit card or wave their phones over the reader to make payments. The way they work is based on shortrange contactless technologies that use magnetic field induction, namely Near Field Communication (NFC), which is incorporated in many smartphones, to replace common electronic payment method (Aris et al, 2022).

Just to mention a few numbers, Italy is the European country with the most POS, reaching 3 million units in 2022 (Innovative Payments Observatory of Politecnico di Milano, 2023). POS have been around for almost 50 years. The first POS that came around was the traditional POS in the 70's and it's been at the center of payment acceptance so far. Then, in 2014, the first Mobile POS was revealed, but only in the latest years it received a strong enhancement. Transactions in the mobile POS field rely on contactless interaction between a smartphone application that saved a digital payment card in a mobile wallet and a merchant's payment terminal (Gerpott & Meinert, 2017; Schilke et al., 2010). In this case, data is transferred through, e.g., NFC or starting the payment by scanning a QR-code (Gerpott & Meinert, 2017; Statista, 2021d). Since NFC permits smartphone users to store account information into mobile application and transferring information securely, by touching or waving, this new method of mobile payment is seen as convenient, secure, and fast (Leong, Hew, Tan, & Ooi, 2013).

In Malaysia specifically, Maybank was the first local bank to launch the use of NFC-based mobile payment, followed by CIMB. In early 2017, Samsung has partnered with few other banks such as Standard Chartered and Hong Leong Bank to roll out the use of NFC. Bank Negara Malaysia has also collaborated with Bank of Thailand to launch mobile payment application with QR code-based to enable consumers to make cross-border payments (Phillips, 2021). Today, there are more than 40 NFC payment type

existing in Malaysia implying that the technology is growing in the country (Alam, Awawdeh, & Muhamad, 2021). With the emergence of Covid-19 pandemic, the use of NFC technologies is proved to be crucial since contactless payment can avoid the spread of the virus. Malaysia recently was reported to lead the Asian region with the adoption rate of 40 per cent ahead of other neighboring countries, showing the potential of NFC technology (Aris et al, 2022).

In 2019 the Smart POS made its first appearance, along with an ecosystem of applications, like accepting payments through a QR-code. It is also equipped with a touch screen, enabling it to access different functionalities. And only in the latest years the Software POS was developed, reaching new heights in the world of payment acceptance. Until 2022, traditional POS were the most used in italy, with a total of 60% units owned, followed by Mobile POS with 30% and a small percentage of 9% of Smart POS. Traditional POS usage has been decreasing in the latest years, showing a higher interest towards more advanced POS. Software POS are the latest trend as they allow merchants to accept contactless payments directly from their smartphone or tablets, without the need of a specific hardware (Innovative Payments Observatory of Politecnico di Milano, 2023).

All the new versions of the POS are user friendly; they can communicate and integrate with other devices, they can be carried around and there are new business models that are being developed around them.

Even though the payment acceptance paradigm is changing, the traditional payment methods are still widely used all over the world, and it is based on d**ebit and credit card**. Debit and credit cards, long-standing pillars of the global payments industry, continue to play a pivotal role in the financial lives of individuals and businesses. Despite the rapid proliferation of innovative payment methods, these traditional forms of payment have demonstrated remarkable resilience and adaptability. In fact, according to data from the Federal Reserve, in 2019, there were approximately 483.8 million credit cards in circulation, accounting for billions of transactions worth trillions of dollars annually (Federal Reserve, 2020). As FIS reported, during 2022 debit and credit collectively were used 49% of the time at a POS around the world. They may vary in popularity or market share compared to other methods, but as cash loses ground, the first ones to have something to gain are cards. As Wallet Hub mentioned, credit cards have had a hard time keeping up with the lower fees of instant payment rails. The three biggest complaint customers had with credit cards were collection issues (32.95%), billing problems (19.38%) and the payoff process (6.04%).

The continued usage of debit and credit cards can be attributed to several factors:

- Merchant Acceptance: debit and credit cards are universally accepted by a vast network of merchants, both in physical stores and online. Their wide availability makes them a practical choice for consumers worldwide.
- Consumer Habit: they tend to be deeply rooted, and individuals are often more comfortable with the familiar process of swiping, inserting, and putting the cards' pin.
- Rewards and Incentives: credit cards frequently offer rewards programs, cashback, and travel perks that encourage cardholders to make purchases and pay bills with the same card over time, enjoying benefits like discounts, miles, or cashback (Statista, 2021).
- Security and Fraud Protection: credit cards provide robust security and safeguards against unauthorized transactions, generating trust among users (Federal Trade Commission, 2021)
- Global Versatility: Debit and credit cards are universally recognized and accepted, facilitating cross-border transactions and international travel.

While innovative payment methods have made significant inroads, along with new ways of accepting them, debit and credit cards remain vital instruments in the global payments' ecosystem. Their enduring appeal is attributed to their widespread acceptance, consumer familiarity, rewards programs, security features, and global versatility. The future of payments is likely to be characterized by an evolving mix of traditional and innovative methods as technology continues to advance and adapt to meet the needs and preferences of consumers and businesses alike.

1.2.3. Technological solutions

In this group all the trends that are based on new technological developments will be analyzed. The first one is based on **Security and Privacy**. The digital economy is growing rapidly as technology continues to remove borders and barriers. As the digital economy grows, so too does uncertainty and more sophisticated fraud. Sophisticated fraud such as account takeover impacts consumers and businesses alike. An important aspect that impacts everyone, despite the payment methods they decide to rely on, is security. It is the driving force for the advancement of the payment technologies. If the security is not up to date, then it causes difficulties in evolving the payment technologies. Security is a vital component in payments as a massive amount

of payment data pours into the bank. That's the reason why many banks are looking for machine learning to accomplish this task.

Banks constantly feed Machine Learning, or ML, with new transactions and this constant feed shows ML the difference between the normal transaction and the fraudulent one. ML software studies these cases and learns to detect the fraudulent transactions in real-time. For example, when a text message is received on behalf of the credit card company that asks if the transaction is fraudulent, it means that the ML software sent it to alert the card owner about any fraud.

As Claire Deprez-Pipon said, in 2019 80% of the value of card fraud resulted from card-not-present (CNP) transactions. To reduce this number, the reinforced one-time Password SmS (OTP) has often been deployed as a complement to a mobile strong authentication method, because it is simpler to implement, and allows it to meet time constraints. However, it is a less secure method (the SmS is not encrypted, the message can be intercepted; the OTP and the password are privileged factors for phishing because they are easily transmitted). To remove friction from the user journey, banks could implement a transparent authentication factor and/or a biometric solution. The transparent authentication factor is a good alternative to SmS OTP, as it eliminates an authentication step thanks to the possession factor which is transparent while providing a higher level of security; the biometric solution, whether linked to the OS (smart-phone biometrics, computer biometrics), or via external solutions, is preferred by many users as it improves the overall experience with password-less authentication (74% of respondents chose biometric authentication as their preferred method), which can increase the success rate by at least 10% (The Paypers, 2023). Also, using biometric payment cards enables consumers to authenticate higher payment amounts by means of fingerprint verification, eliminating any requirement to insert their card or enter a PIN while paying for larger transactions at the POS.

Biometric is nothing but measurement of physical characteristics like fingerprints, retina, iris, voice, face, vein infrared thermogram, eye, or combination of all these characteristics. The biometric authentication has been quickly adopted by several banking institutions as the latest form of digital security, since it's been estimated that the PIN numbers are going to get obsolete. Also, biometric authentication has proved to be a safer alternative to the PIN or any other process.

A good example of how biometric payments can be secure and useful to avoid frauds are **voice payments.** Voice technology has led people to be comfortable using voice options in many ways. From sending money to a person to ordering groceries through

an app or interacting with their favorite store, voice is becoming the dominant method for using mobile devices. And this market is projected to grow significantly through this decade. A Juniper report forecasts that voice commerce is expected to reach some $80 billion by 2023, while transactions by smart home devices are expected to hit $164 billion by 2025 (Kinsella, 2019). This anticipated growth of the voice payments market is being driven by hundreds of voice commerce solutions from payment service providers. This is in turn growing the market and turning more customers on to voice payment solutions (Blutag, 2022).

The process of setting up a voice payment account is very similar to that of paying through any online wallet. In both cases, the customer must first link their credit/debit card, or their bank account details to their devices. However, in a typical wallet scenario, the customer most likely must open the app, manually type in the details of the amount and the receiver, and then press the ok button to facilitate the payment. However, in the case of voice payments, the customer can simply prompt his device to make the payment with a voice command, and the following steps will proceed: the sender will open the app and prepare the amount to send, the app will ask for a password, or a fingerprint scan and the receiver will get a notification about the payment received (Blutag, 2022).

As biometric authentication methods become more widely accepted and contactless payments are the order of the day, voice payments are likely to grow. It takes the hassle out of pins and passwords, as many believe a voice can't be hacked. According to Melinda Ziemer, voice payments decouple any personal information from the voiceprint, so it's not connected to any sensitive customer information." It's just a bunch of 0s and 1s". Routine transactions like money transfers, bill payments, and card activations can be done quickly and seamlessly. But it's not about convenience and accessibility alone. Voice payments offer new, cost-saving integration opportunities across digital payment touchpoints.

Voice-based payments are a natural outgrowth of the voice assistant revolution, led by Amazon's Alexa, Apple's Siri, Google Assistant, and others. Amazon was first to release its smart speaker in 2014. Whereas Google came with Google Home in 2016 followed by Apple in 2017. Smart speakers receive voice commands from the users. The users can give different kinds of commands like booking Uber, getting information about the nearby restaurant, or getting weather updates. Amazon has surely taken a lead when it comes to payments made via smart speakers. Many companies have also shown a keen interest in incorporating their payments via smart speakers. For example, Domino's Pizza has now allowed all the users to place orders

through Amazon Echo. Earlier, Amazon had also decided to allow its smart speakers to be used by several vendors for payments. Alexa users are already accustomed to authorizing payments via their faithful smart speakers when they purchase items from Amazon.

Recent industry figures from Voicebot Research (Kinsella, 2021) show that there were some 45 million adults in 2021 who had used voice assistants to shop for products at least once. That's a big jump from 2018, when similar research showed only 20.5 million U.S. adults had used their voice to shop at least once for a product, which represents a 120% increase.

PaySafe collected answers from a sample of people, and they realized that one third of respondents are still reluctant or didn't have a chance to pay by using their voice, as can be seen in Figure 2.

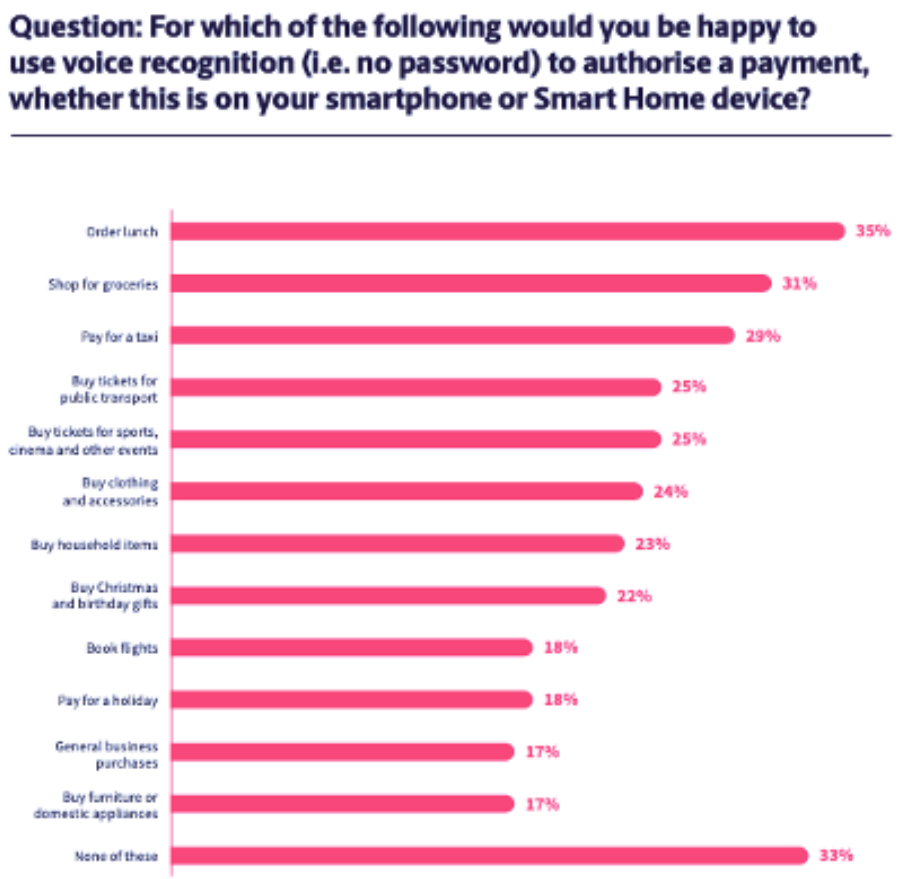

Figure 1.2 - Voice Payments survey (PaySafe, 2019)

The rise in the popularity of voice payments is a tribute to the '24/7 connected' lifestyle. In the modern world's fast-paced environment, voice payments are offering consumers services that save their time and are easy to use. On the other hand, brands win because they get access to the personal data and behavior trends of their customers they did not have before (Blutag, 2022).

In many ways, the challenges presented to voice payments are the same as for any new technology — unfamiliarity, and a lack of trust. Voice payments, like any novel tech, need to justify the gap it is filling, and with money involved, it needs to become extra credible to have a wider adoption. The main challenges they are facing today to bring voice payments to a daily use for more people are security and privacy of all the data that will be collected by the systems when speaking, understanding different accents, and POS integration.

Another example of trend in the Technological Solutions group is based on **Cashflow Management.** Cash flow shows how healthy a business's money is. Keeping track of cash is super important for a business to grow, and a cash management system helps finance people handle this. These systems keep a record of how money moves in and out of a business. They watch over cash as it moves between different parts of the company. More and more businesses are using cash management systems. Experts think the market for these systems will be worth about $25.37 billion by 2027 (Grand View Research, 2023).

Usually all cashflow management systems have a hardware and a software. Lately, they have also been implemented with AI, which has been fueling the market's growth. The process of cash management and cash forecasting has been revolutionized by the implementation of AI technologies such as machine learning, robotic process automation, and deep learning. The process of cash management thus resulted in greater efficiencies, enhanced productivity, and higher profitability. The technology benefits by eliminating the need for manually performing the tasks like reporting payables, receivables, and others enhances the effectiveness of such tasks, along with increases the efficiency by reducing time demand.

There are different sectors in which these systems are used to keep track of their balances. The one with the highest use is the bank sector, which is expected to dominate the market over the next years, owing to the increased adoption of money management systems to reduce the time required for the transaction process and to help increase the high net profit of the banks. These systems also help the banks to improve the technical proficiency of their employees. Various services offered by these

systems include advanced web services, account reconcilement services, and balance reporting services. For what concerns the commercial segment, it is expected to emerge as the fastest-growing end-use segment over the next years. Various commercial businesses are widely adopting money management tools to optimize their business cash flow. These tools allow businesses to access a suite of online receivable, payable, and reporting solutions to meet the needs of the business. Moreover, these tools allow easy access to e-Statements and balances and transaction information through a consolidated dashboard (Grand View Research, 2023).

1.2.4. Blockchain

The Blockchain system has been in the eye of the storm in the latest years, especially after 2019 when Bitcoin got the attention from most of online investors. It is a set of technologies that build the foundation for cryptocurrency's functioning**.** **Cryptocurrency**, instead, is a digital currency for digital transactions, and it mainly involves transactions carried over the internet. It drives it forward through the concepts of decentralization, privacy, and verification. The reasons why cryptocurrency promises to be the future of digital payment are the following:

- Secure: Cryptocurrency is one of the safest currencies in a world where physical money is constantly under the threat of theft. The buyers and the sellers in cryptocurrency transactions have the ledger's copy that records all transactions. Thus, cryptocurrency is entirely safe against malicious intrusions. Instead of relying on a single trusted intermediary, such as a bank or credit card network to transmit and verify a transaction, the crypto system relies upon many competing ''miners'' to verify transactions. A miner is just a computer that is attached to the internet and that performs the computations needed to verify each transaction. There are two major types of blockchains, which are permissionless blockchains and permissioned blockchains. In a permissionless blockchain, also called public blockchain, anyone can become a miner (validator) and perform transactions. In contrast, a permissioned blockchain allows a limited number of nodes to participate in consensus and only registered users to make transactions (Islam et al., 2023).
  In the bitcoin system, a transaction is publicly announced to the network. The miners effectively vote on the legitimacy of each transaction as part of the mining process by time stamping each transaction and verifying that no one has

double spent that money before. All transactions are recorded in a public ledger known as the ‘‘blockchain’’ (Angel and McCabe, 2014).

Although cryptocurrencies seem to be secure, there still are some drawbacks, like high key management risks. Unlike conventional banking systems, there is no password or key recovery option. If a user loses their private keys, they cannot spend their inbound transactions belonging to the keys, and the funds will be forever orphaned in the network. This can bankrupt a wealthy cryptocurrency user in a matter of seconds, with no chance of recovery because a private key cannot be retrieved from its public key. This concern, however, can be alleviated by implementing a refunding protocol (Islam et al., 2023). Both consumers and merchants must take precautions that their Crypto wallets do not get hacked, leading to unrecoverable losses.

- Decentralized: Cryptocurrency’s nature is such that it removes any central body’s need to govern or regulate the transactions, like a Central Bank. Unlike conventional banking, no single authority controls the cryptocurrency network, and the only parties involved in the transaction are the buyer and the seller (Angel and McCabe, 2014). There are numerous cryptocurrencies in use today, where most of them are fully decentralized and non-auditable. Anyone can connect to the networks and conduct anonymous transactions without having to comply with any regulations. But absence of auditing enables bad actors to engage in criminal activities such as money laundering, transferring illegitimate assets, smuggling, and terrorism. Because their identities are concealed in the network, they can continue their illegal activities. As a result, governments are getting concerned about the evolution of these virtual currencies since citizens cannot be stopped from utilizing them in illegal ways. Some countries such as Algeria, Egypt, Morocco, Bolivia, Ecuador, Bangladesh, Pakistan, and Nepal have already prohibited their citizens from using Bitcoin. According to Wikipedia, Bitcoin is illegal to trade in the banking sectors of several countries, including China, Taiwan, Russia, Canada, Colombia, Cambodia, Saudi Arabia, Iran, and Jordan. These prohibitions, on the other hand, deprive citizens of their legal rights to use the digital currency and all their benefits coming with them (Islam et al., 2023).
- Faster transaction speed: Any transaction in any part of the world can happen at higher speeds, thus increasing cryptocurrency’s efficiency. Thanks to Blockchain technology, which is the digital framework on which cryptocurrency works, cross-border transactions across the globe can be done

in seconds. Furthermore, it costs almost nothing to receive a bitcoin payment, although a merchant would have its own administrative costs of installing the software to handle bitcoins, transaction fees for converting to other currencies, and the risk of operating with multiple currencies. The reduction in transaction costs also has potential to reduce the cost of international remittances, which would benefit poor migrants sending home funds to their families (Angel and McCabe, 2014).

- Versatile: Unlike banks, cryptocurrency transactions can be entirely private as no authorized third-party controls or regulates your money. Thus, there is no need to reveal any sensitive information to anyone. The transaction charges are also meager as compared to traditional mediums. The other important thing to keep in mind is that they can be used anywhere without the fear of devaluation or inflation.

The main problem is that for the last years Cryptocurrencies have been used mostly as a form of investment tool, not to pay for products and services. In 2022, cryptocurrencies accounted for less than 0.2% of total global e-commerce value, because people are still not used to this form of payment and merchants are yet not aware of all its benefits (FIS, 2023). Today, various services over the internet and online shopping establishments accept cryptocurrency as a form of payment. Major online gaming platforms are now incorporating cryptocurrency into their gaming systems. Some cryptocurrencies are explicitly established for online gaming and entertainment, such as Game Credits, Funfair & Enjin. They offer faster transaction times and reduced volatility. Goods and services can be traded for cryptocurrencies, as well as trade one cryptocurrency for another. Foreign exchanges, goods & services can also be exchanged for cryptocurrencies. However, there are tax implications in places where cryptocurrencies are legalized.

In order to accept cryptocurrencies as form of payment, a crypto POS system should be used by the merchants. It is a solution for deploying a cryptocurrency payment gateway, says Sascha Munger. It is important for merchants not to be exposed to any acceptance hurdles and to be able to accept crypto payments like any other means of payment. An example is the development of an app for the integration of cryptocurrencies at the POS and the merchant can accept crypto payments immediately after a brief onboarding process (The Paypers, 2023).

Before merchants can accept any cryptocurrencies as form of payments there are some fundamentals that must be respected, says Eric Barbier. Acceptance of the law is a first step. Before developing the final product, extensive checks and balances must be put

in place, so that illicit activities and money laundering can be avoided. Then, the payment experience must be seamless, flawless, and intuitive.

The use of cryptocurrency has increased notably since the start of the pandemic, especially in emerging markets, such as Africa. According to Triple A's latest crypto ownership data from September 2022, with an estimated 53 million cryptocurrency owners, the African continent now accounts for 16.5% of the global total. Nigeria, which has more than 22 million crypto owners, currently accounts for more than a third of the continent's total number of holders (the US has 46 million, India 27 million, Pakistan 26 million, Nigeria 22 million, and Vietnam 20 million). The main reason for this is that the crypto ecosystem is seen, to some extent, to allow users to circumvent some requirements that can be found in the traditional financial system through several means. Some examples are the use of exchanges and other crypto-asset providers that would be non-compliant with sanctions and/or capital flow management measures, a poor implementation of adequate due diligence procedures by crypto asset providers, and the use of technologies and platforms that increase the anonymity of transactions (such as mixers, decentralized exchanges, and privacy coins). Digital currencies can also provide insurance against exchange rate fluctuations; the value of the Nigerian Naira has plummeted almost 30% against the dollar in the past five years, says Estelle Brack. In late July 2021, the government of Nigeria announced a pilot scheme for a new central bank-issued digital currency (CBDC), eNaira, hoping to reduce incentives for those wanting to use unregulated crypto. Today, every Nigerian can – and does – exchange eNaira through text messages on mobile phones.

1.2.5. Sending payments

In this groups all the trends that have to do with the managing of sending payments from companies or final consumers have been considered. One of the most important is **Cross-border payments**. With the growth of ecommerce, many businesses have gone global, requiring them to activate cross-border payments. These payment methods have intermediaries that often come with high costs and fees. Transactions performed using traditional methods come with several restrictions, such as limited operating hours and a lack of transparency. Additionally, it's worth noting that a significant number of cross-border payments involve the use of two distinct currencies, which essentially transforms them into what is referred to as cross-currency payments. In these cases, the process becomes more intricate due to the need

to convert one currency into another during the transaction, and this factor can introduce additional complexities and considerations for those involved in the payment process. An interesting fact is that to make cross-border payments two bank accounts are needed and there are many countries, especially African countries, where people don't have one, such as Sub- Saharan Africa, North Africa, and the Middle East (BIS, 2020).

Several studies show that using cryptocurrencies for international remittances and payments can help lower those fees (Islam et al., 2023). A survey by Stellar Development Foundation and Wirex found that 52% of respondents consider cryptocurrencies an excellent alternative to sending money overseas via more traditional methods, and 53% of them believe that international fees from traditional payment methods are too steep. This can significantly impact the sales and revenue of businesses with international customers. Since cryptocurrencies run on blockchain technology, they don't require intermediaries. This effectively lowers transaction fees, allowing transfers to happen in real-time. Merchants simply must present their public cryptocurrency wallet address to their customers.

Due to the absence of oversight, enterprise self-discipline must be implemented, which inevitably raises credit risk and transaction costs for businesses. Cross-border e-commerce is more difficult to navigate than domestic e-commerce because of the inherent intricacy of trading between countries. Therefore, businesses engaging in cross-border e-commerce not only face the challenges of cross-border logistics, currency rate, and other unknown variables, but also face the additional time and money costs associated with multiple intermediaries (Fu and Saad, 2023). Some of the problems they must face are anti-money laundering AML and counter-terrorist financing CTF regulations and customer mandates. AML and CTF are necessary but tricky, since every jurisdiction implement them differently, meaning that the sender will have to satisfy different data and document to get the permission to send money abroad (The Paypers, 2023).

The good news is that cross-border payments are now receiving more attention than before. From 'having been the forgotten corner of the global financial plumbing' (Cunliffe, 2020), these payments have moved up the political agenda internationally. Today, many public and private initiatives in the field of cross-border payments are ongoing. An important catalyst has been the ambitious G20 program to improve cross-border payments (Claussen and Pedersen, 2022). In 2020, G20 leaders adopted a 'roadmap' for enhancing cross-border payments. This followed extensive work by central banks and international organizations to describe the problems of cross-border

payments and identify their root causes, or frictions (FSB, 2020a). Some of these problems are fragmented and truncated data formats, complex processing of compliance checks, limited operating hours, high funding costs, long transaction chains and weak competition. For what concerns cost, although digitalization has made instant cross-border communication almost cost-free which means that international electronic payments should have enormously benefited from this, there has not been a striking decline in the costs associated with executing cross-border payments. Two main reasons have been identified for this. First, intermediaries continue to struggle to ensure compliance with regulations and fear the legal and reputation risks of non-compliance. Second, although payment service providers have improved the "front-end" of completing cross-border payments in the form of enhanced user convenience, the "back-end" of facilitating payments, through payment and market infrastructures, continue to face many challenges (ECB, 2022).

In general, cross-border payments have been undergoing a process of development in recent years, with the aim of enhancing the speed, safety, and affordability of these transactions. However, it's important to acknowledge that there are still certain challenges and issues that need to be addressed and resolved. This is essential to ensure that both businesses and individuals, who engage in sending or receiving payments across international borders, can experience satisfaction with the service and choose it over alternative payment methods. The continuous improvement of cross-border payments is a work in progress, with the goal of making these transactions more efficient and reliable for everyone involved.

1.2.6. Open API

In this group the trends relative to Open API have been analyzed. Payment methods based on Open API, like account-to-account payments move money directly from a payer's bank account to a payee's bank account without the need for intermediaries, such as credit or debit cards. New ways of making digital payments are becoming available to more people, such as Apple Pay and Google Pay. However, the bulk of these payments still go through the existing card systems (usually Visa or Mastercard) rather than customers paying retailers directly from their bank account.

Open APIs enable third party developers to build innovative apps, deliver enhanced capabilities in the marketplace, and provide better omnichannel customer experience and so on (Premchand and Choudhry, 2018). It is a technique that enables

organizations to share their business processes, data, services, and applications with partners and internal and external developers. APIs are not simply technical interfaces, rather these should be considered as enablers for creating compelling customer experiences (Premchand and Choudhry, 2018). Open API is the technical realization of Open Banking (McKinsey, 2014), which will be better explained later . "Open" does not mean that every third party can access a firm's system at their discretion. There will always be some form of control by the firm, in order to preserve security, privacy and contractual conditions (Kim, Hwang, Jae, Jun, and Kwon, 2016). Most digital market participants have used API technologies to meet their business objectives and ultimately create customer or platform value. They have discovered that using APIs in 'opening up' systems (to the outside world) is essential for driving traffic to software assets, for cocreating end customer value in the ecosystem and for sharing the burden and benefits (including the profits) between the parties involved when unlocking new markets (Gozman et al., 2018). An important means of value cocreation through APIs is through enabling third parties to build applications 'on top' of the platform. Some examples include Facebook, Amazon, eBay, PayPal, Twitter, and Google. Developers can reuse existing functionality or use multiple data sources to enrich their own applications. This lowers cost and speeds up time-to-market, but also creates additional dependencies on third party developers. For API providers, this way of value co-creation provides a wider distribution network, creating traffic and minimizing innovation costs, which are carried by third parties (Gozman et al., 2018). It's important to note that all the services offered by Open API are not fully developed, or at least they can still be further developed to increase the performances of those, (Innovative Payments Observatory of Politecnico di Milano, 2022). It is safe to say that in the coming years there will be many more new players that will increase the number of services offered and improve those already available.

In 2022 in Europe there were a total of 356 Third Party Providers, and 19 of them were present in Italy. In the first semester of 2022 in Italy there were 105 million calls that were the results of Account Information Services AIS, while payments initiation services are still low, with a value of 10,4 million calls in the first semester. These results show that they are still not popular among the Italian population, but the first solutions about Open API are beginning to spread and show their potential (Pellitteri et al., 2023).

In the latest years Open API has grown exponentially, mainly because of the implementation of PSD2, or Second Payment Service Directive. As explained by the European Commission, "The revised Payment Services Directive (PSD2), will facilitate

innovation, competition, and efficiency. It will give consumers more and better choice in the EU retail payment market. At the same time, it will introduce higher security standards for online payments. This will make consumers more confident when buying online. PSD2 scope extends to innovative payment services and new providers in the market, such as FinTechs. These players are also called Third-party Payment services Providers (TPPs)". Following a disappointing reaction to the first iteration of PSD, the new Directive is geared towards encouraging new ideas in the payments market, especially among tech start-ups (Mansfield-Devine, 2016). In essence, PSD2 means that any business, a social network or an app developer, can handle payments on behalf of its users. All it needs is the user's permission and access to the bank's API, which the bank must grant. The idea of APIs is to cut out the existing middlemen, which are payment service providers and card payment providers that charge higher fees.

One of the ways in which PSD2 will open the payments sector is through the creation of TPPs, or Trusted Third Parties. These will provide a link between retailers and the banks, cutting out the traditional payment processing firms. Each TPP will fall into one of these groups:

- Payment Initiation Service Provider (PISP): this organization initiates the payment process on behalf of the user using APIs provided by the banks (who must provide access to these APIs if the customer has given permission to the PISP). Funds are moved directly from the user's bank account to the merchant, eliminating the fees usually charged by payment card companies. According to McKinsey (2021), Open Banking ecosystems can add up to 1.5% to the GDP of the EU, the UK, and the US. One of the advantages of Open Banking is the ability for consumers to use Online Banking Payments to pay merchants. PSD2 has acted as a catalyst for this by requiring that all banks allow and support authorized service providers to initiate payments. This category includes companies offering inter- and intra- API-led connectivity, which is a methodical way to connect data to applications through reusable and purposeful APIs. These APIs are developed to play a specific role – unlocking data from systems, composing data into processes, delivering Open Banking payments experiences, and designing account-to-account payments that suit businesses and their customers (The Paypers, 2021).
- Account Information Service Provider (AISP): this organization has access to a user's bank information and can, for example, aggregate information from a single user's multiple bank accounts into a single source. This will allow

businesses to build applications and services around this information with the goal of attracting technology start-ups with no connection to the current banking sector to create innovative services.

- License as a service (Laas): this category includes white-label solutions spanning across multiple core banking modules, channels, and payment solutions to meet the operational needs of a bank. When it comes to banking-as-a-service (BaaS), this plug-and-play approach enables service providers to embed a wide range of financial services into their suite of offerings for their customers to access those financial services despite not necessarily being customers of the underlying bank. The players included in this category can offer Bank in the Box/Banking-as-a-Service/Account management/Payments/Processing/Cardsolutions to banks, fintechs, marketplaces, and large corporates (The Paypers, 2021).

Open Banking (the "evolution" of Open API) is a UK-started and now globally accepted movement toward improving customer data portability in the financial space. Open Banking enables personal customers and small businesses to share their data securely with other banks and with third parties, allowing them to compare products based on their own requirements and to manage their accounts without having to use their bank. Open Banking can be thought of as "finance as a service", a form of software as a service or SaaS (Laplante and Kshetri, 2021). Therefore, Open Banking challenges many of the institutionalized assumptions in banking, such as the regime of opacity (Funk and Hirschman 2014; Scott and Bolotin 2016) and asymmetric information (Greenwald and Stiglitz, 1994). There are new entrants who are attacking the incumbents with new technology innovations and business models, while the financial industry incumbents try to fight off the attacks by investing more and more in their existing infrastructure (Hedman and Henningsson, 2015).

Around 7 million consumers in the UK used Open Banking services in January 2023 alone (Wood, 2023). The common use cases include bank account aggregation (i.e., the ability to keep data from multiple bank accounts in one place), personal finance management, and faster customer onboarding. Open Banking payments have now become the next frontier for expansion, since such payments can eliminate third parties (like card acquirers, card networks, and settlement banks) from the standard

payment processing flow. There are some requirements that Open Banking needs to function correctly: legislation, API standard cooperation by financial entities and consumers, a high level of cybersecurity and trust (Laplante and Kshetri, 2021).

When talking about Open banking, there are different players to take into consideration, operating under the PSD2 regulatory framework. One of them is the open banking platform, which provides access to bank data and payments for Payment Service Providers, also called PSPs, and developers, or assisting banks to publish the dedicated PSD2 compliant interfaces (APIs) via a set of consistent and cost-efficient products or building valuable use cases on the new Open Banking infrastructure. Moreover, this player can unlock the payment data of banks' clients and give online and offline retailers access to this anonymized data to perform payment marketing campaigns. They can help banks and e-wallets become PSD2 compliant, building API channels for PSPs and developers to have access to end-customers' accounts information and payment initiation. The companies included here can provide compliant access to TPPs, for Payment Initiation and Account Information Service provision (The Paypers, 2021).

1.2.7. Other

In this group all the trends that were not put in the previous categories will be analyzed. The first trend is **Buy now pay later** (BNPL), which used to be a special offer from merchants, and is now used to entice buyers to make a purchase. As of today, however, it has become a standard offering. This form of financing works similarly to credit cards but provides a workaround to lower interest rates and fees and avoid credit checks. The BNPL business model, on the other hand, is a novel approach to instalment loans. It enables customers to take possession of their purchase immediately, with or without a down payment (Arisandy et al, 2023). According to Insider Intelligence, the BNPL payment method appeals most to Millennials and Gen Z. Ernst & Young stated that Gen Z is most likely to shop online for efficiency (Schlossberg, 2016). The main reason why Gen Z teenagers like this method of purchasing products on-line are time saving, higher selection of products, lower prices, products are categorized in a way that makes it easy to purchase (Eneizan, 2020).

In a report by FIS, it was shown that over the past few years, the BNPL market has grown significantly. It projected that BNPL will account for 9% of all North American

e-commerce transactions and 12% of all European e-commerce transactions by 2025. In the same report Sweden appears to be the leading country in Europe for the usage of BNPL which is also the most used payment method for e-commerce, with a 24% usage, followed by Germany with 23% (FIS, 2023).

In 2022, BNPL accounted for over $100 billion of Asia and Pacific's e-commerce transaction value, with China being in the first place thanks also to the implementation of BNPL as a payment gateway when making purchases through their super apps, such as WeChat and Alibaba (FIS, 2023). In the same report by FIS Sweden appears to be the leading country in Europe for the usage of BNPL which is also the most used payment method for e-commerce, with a 24% usage, followed by Germany with 23% (FIS, 2023).

In Italy, as the Innovative Payments Observatory of Politecnico di Milano noticed, 2 billions euros were spent in online transactions using a BNPL system, while "only" 300 million euros were spent in a physical store. Those 2 billion spent online in italy using BNPL accounts for a total of 4% of the total amount of money spent for e-commerce in Italy in the same year. A survey made by the same Observatory found out that 13% of the Italian population has used the BNPL solution to make a purchase: 71% of them used it only to make a purchase online, 20% only in a physical store and 9% both online and in store. Also, people who have tried this solution to make a purchase are much more likely to use it again, as it was discovered that 87% of users will do that again.

A study conducted in Australia in 2021 comparing the amount of money spent by consumers utilizing credit cards vs. cash vs. BNPL reported that consumers spent more on BNPL, since the amount of money spent felt smaller to them when split across several payments compared to paying for the full purchase up-front. One article from Klarna noted average order values were approximately 45% higher for retailers offering a BNPL checkout option. All these findings reinforce the fact that having a BNPL solutions for a business as a payment acceptance method will increase the average order value, number of orders and consumers will be more satisfied with their purchases, increasing the possibility of them purchasing again from the same business.

The most ardent supporters of Buy Now Pay Later (BNPL) payments are members of the younger generations, specifically millennials and Gen Z (Backman and Caporal, 2023), even though it came out from a study of Arisandy et al. that "millennials" (people born between 1982 and 1994) used BNPL services more than Generation X (between 1965 and 1981) and Z (52% vs 28% and 12%). Generation X and Z have

limited credit histories but ambitious goals. Therefore, they do not like conventional payment options such as credit cards or loans (Novendra and Aulianisa, 2020). They require a rapid, easy, and minimally administrative procedure (Lia and Natswa, 2020). Previously, it took months or even years to establish financial credibility using conventional methods (Gerrans et al, 2022). However, with real-time data, all of this is now possible.

Based on a study made by Arisandy et al, it came out that age, income, and loan amount are three characteristics that have a negative impact on loan default, as shown by the graph. For instance, the younger the customer, the higher the likelihood of loan default. The same study shows that males are most likely to use this kind of service (62% vs 38%), mainly because man like the practicality of BNPL (Arisandy et al, 2023). Gen Z has the greatest default rate on pay later services. Compared to earlier generations, Gen Z devotes most of their income to online shopping, according to survey results. Gen Z has the highest proportion of spending relative to income compared to older generations, who dedicate less money to online shopping. But Gen Z are not financially independent and do not have a steady income. When compared to other generations based on length of time employed, Gen Z has the highest number of people who have worked for 0-8 months. The multivariant analysis demonstrates that consumers with a year of service of 0 or less months or who are unemployed have the largest number of defaults, implying that teenagers with no experience at work are less likely to know how to manage savings (Arisandy et al, 2023).

Moreover, building on the e-commerce momentum from the Covid-19 pandemic, the BNPL model is one of the fastest-growing segments in consumer finance. Considering the impact of inflation and weaker consumer spending on company valuations post-pandemic, the growth potential of BNPL is likely to help it weather economic headwinds (Perlin, 2021). This new trend on e-commerce sites is increasing in popularity since credit cards are declining in popularity. Millennials and Generation Z avoid credit cards and embrace ecommerce, and the BNPL market is expected to grow exponentially, keeping up with what is popular and what will earn the most sales. BNPL can stimulate e-commerce demand because it reduces customers' cash flow pressure, making it easier for potential customers who cannot afford what they want.

The second trend that will be analyzed in the Other group is that of **wearable payments.**

There is a payment system which is different from the others in terms of how it is carried around by buyers, which are wearable devices on which payments can be made. Wearable payment, which refers to the use of accessories or clothing that are enhanced with electronic technology to make payment, is expected to significantly catalyze the shift of consumers from cash toward electronic transactions. With the rapid expansion of IoT, wearable devices offer a chance to facilitate payments beyond the confines of mobile phones, cards, and point-of-sale terminals, to a broader and more diversified ecosystem of Internet-connected devices (Lee et al., 2020).

Wearable devices can be used to make payments thanks to the addition of NFC technology in them, which enables transactions to be conducted merely by holding a mobile device within the range of the NFC terminal at a POS (Chen & Chang, 2013; Gerpott & Meinert, 2017).

The intention to adopt and actual usage of wearable payment has been increasing around the world. Wearable payment is different from traditional mobile payment that involves the use of smart mobile devices, particularly smartphones, given that smart mobile devices have become essential in daily life, while wearable technology is considered a fashion accessory and still in the beginning stages of its product life cycle. As wearable technology adoption is still not that high, it is more common to see consumers paying with smart mobile devices (Loh et al., 2022). With the popularity of mobile payment, wearable payment is predicted to open up doors to more business opportunities in several different product categories. However, the market penetration rate for such a payment method remains low (Jeong et al., 2017).

Wearable devices are among the most important IoT items in the global market with a significant increase in sales of approximately 141 million units in 2019. This increase doubled the total sale in 2017 (Park, 2020). The recent forecasts on smart wearable devices stated that the sales of IoT-based and smart wearable devices could reach 57 billion USD by 2022, 64 billion USD by 2025, and 104 billion USD by 2027 (Svertoka et al., 2020). Based on other surveys of contactless payment systems conducted in 2019, 67% of customers were engaged in a m-payment transaction with 19% growth in Thailand, 24% growth in Vietnam, and 20% growth in Middle East countries (Aji e al., 2020). Hence, with the consolidation of statistics of the rise in usage of smart wearable devices and the usage of contactless payments, a high prospect of wearable payment devices could be presumed in near future (Al Manun et al., 2023).

The Innovative payments Observatory of Politecnico di Milano found out that in italy, in 2022, wearable payments account for 5% of the total mobile payments' transactions,

which is around 800 million euros. Although this percentage is low compared to mobile payment, it's important to underline that it's been growing every year and it should keep growing in the following years (Innovative Payments Observatory of Politecnico di Milano, 2023).

Wearable payments are becoming popular across Europe and there is eight times increase in wearable payments transactions in just 1 year and 10 countries (Netherlands, United Kingdom, Switzerland, Russia, Poland, Sweden, Czech Republic, Finland, Germany, and Ukraine) are the leaders in SW payments (Mastercard, 2019).

The characteristic of a wearable device is that it must be small, power-efficient, and has the capacity to connect to a hub or gateway device for easy access to the Internet or cloud (Mouser Electronics, 2018). Undeniably, this new technology is creating a trend, and many companies are churning out new designs to fulfil the growing demands for wearable products. Watches, wristbands, glasses, jewelry, and clothing are some examples of wearable technology that are booming. Currently, the most desired forms of wearable technology in Malaysia are fitness trackers and smartwatches (Chuah et al., 2016).

Although there are some aspects that drive people away from using wearable devices for payments. Discomfort and insecurity are inhibitors that delay or prevent the adoption of new technology (Parasuraman, 2000). Discomfort refers to the perceived lack of control and being overwhelmed by technology, including feeling embarrassed for not having the skills to use the technology; while insecurity is described as the lack of trust in technology and its ability to function properly (Shonhe, 2019).

A different concept which is still related to an object which is "wearable" is an implantable QR code subcutaneous microchip. Nowadays, information technology and internet service make people's lives more convenient; meanwhile, the threat of personal information disclosure or theft is also increasing. To ensure personal privacy and information security, user identification and authentication techniques have been ubiquitously deployed in various applications, including access control, payment or banking transfer, transit, individual healthcare, etc. (Wan et al., 2023). An example is the QR code subcutaneous microchip (QRC-SM), which allows enhanced privacy and security while maintaining ease of access. The QRC-SM under the skin can carry useful and private information, and imaging techniques are used for retrieving the information. How it works is that the QR code is made of information with the arrangement of "black" and "white" square elements, which correspond to "0" and

"1", respectively, and can thus be easily recognized by computing systems using the decoding rules. Since the QR code will be planted under the skin, two different QRC-SMs will be created. The first one will have "hole" and "flat" elements (with different depth) on a silicon (Si) chip to stand for the "black" and "white" elements in the conventional QR code image. The second one will have "titanium (Ti)-coated" (and "non-coated") elements to stand for the "black" and "white" elements in the conventional QR code image. Then, ultrasound-related imaging techniques including ultrasound microscopy and acoustic-resolution photoacoustic microscopy, which is one kind of implementation of photoacoustic imaging, will be used to provide sufficient penetration depth and spatial resolution for imaging QRC-SMs. Basically, they will use ultrasound to show the QR code under the skin (Wan et al., 2023). As mentioned above, this technology can be employed for identification and authentication in the process of payment or banking transfer so that individual account security and asset security can be ensured.

1.3. Startup ecosystem

After a thorough analysis on the different groups of payment systems that are part of today's trends, the focus will be shifted towards startups and how they are the main actors influencing the tendencies studied.

Startups play a pivotal role in driving innovation, economic growth, and technological advancement in the contemporary business landscape. These entrepreneurial ventures, often characterized by their innovative ideas, disruptive technologies, and the ambition of their founders, have a significant impact on various industries. Startups have the agility to swiftly adapt to changing market dynamics and experiment with new solutions. They are free of the bureaucratic constraints that often fall on larger corporations, enabling them to pivot rapidly and redefine their business models (Blank, 2013).

The startup ecosystem is a hub of creativity, attracting visionary entrepreneurs and a diverse pool of talent. It provides a platform for risk-taking and fosters a culture of continuous learning and improvement (Ries, 2011). Startups have been responsible for introducing groundbreaking technologies, reshaping traditional business models, and addressing complex societal challenges. In fact, they have disrupted industries such as transportation (Uber), lodging (Airbnb), and personal finance (Square) (Friedman, 2017).

Startups are also significant drivers of job creation, generating employment opportunities and stimulating competition in the market. They are essential for economic growth and often contribute to regional innovation clusters (Feldman et al., 2005). In many cases, startups that begin as small and innovative ventures evolve into major industry players, exemplifying the transformative potential of entrepreneurship. It is crucial to support and nurture the startup ecosystem to exploit its potential for innovation, economic development, and societal progress.

In today's rapidly evolving digital landscape, startups focusing on innovative payments have emerged as pivotal players in the global economy. These companies, driven by a fusion of technological advancements, shifting consumer preferences, and an increasingly interconnected world, are reshaping the way individuals and businesses engage in financial transactions. The study of startups in the world of innovative payments is very important, not only for the academic community but also for governments, businesses, and financial institutions. By exploring the dynamics, challenges, and potential of these startups, it is possible to sought insights into the future of finance and the broader implications of this digital revolution.

The 21st century has witnessed a shift in the way people exchange value and engage in monetary transactions. Traditional financial systems, characterized by paper currency and manual processes, are gradually giving way to innovative payment methods facilitated by startups and incumbent companies, such as Apple, Google, and Amazon. Digital payments are defined by their reliance on electronic channels, avoiding the need for physical cash or checks. These include a wide array of technologies and methods, including mobile wallets, contactless cards, and cryptocurrencies, each offering unique features and capabilities (Kim et al., 2017).

This transition prioritizes user convenience, enhances security measures, and extends the accessibility of financial services to previously underserved populations (Gupta et al., 2020). Thus, the study of these startups offers valuable insights into the social, economic, and political dimensions of the evolving financial landscape. Moreover, innovative payment startups can have a profound impact on micro, small, and medium-sized enterprises. By enabling secure and efficient transactions, they empower these businesses to thrive and compete on a global scale and with bigger companies. For instance, the adoption of digital payment systems has allowed e-commerce platforms to flourish, stimulating entrepreneurship and job creation all over the world (Choudhury et al., 2019). Furthermore, an exploration of these innovative payment startups can offer valuable insights into the dynamic landscape of cybersecurity, the importance of data protection and sensitive user information, and

the development of robust security measures that protect the users and financial institutions engaging in those transactions. As digital transactions continue to increase in volume and complexity, so do the risks associated with cybersecurity.

While the promise of innovative payment startups is huge, the landscape is filled with challenges coming from all fronts. As these startups disrupt traditional financial systems, they raise important questions related to security, privacy, and regulatory compliance. For example, the rapid growth of cryptocurrencies and decentralized finance platforms has prompted regulators to grapple with new challenges concerning anti-money laundering and know-your-customer (KYC) requirements (Böhme et al., 2015). Startups have played a central and transformative role in pushing the boundaries of traditional financial systems, propelling them into uncharted territories, challenges, and opportunities. The regulatory landscape, in response to these transformative startups, must evolve to address new paradigms, ensuring that they reach the right balance between fostering innovation and safeguarding consumer interests, while assessing the potential risks and vulnerabilities introduced by these startups.

For the academic community, the study of startups focusing on innovative payments is an intellectually enriching topic. It combines insights from finance, economics, computer science, law, and sociology, offering an interdisciplinary perspective on the complex relation between technology, finance, and society. It challenges researchers to explore topics ranging from consumer behavior and payment adoption patterns to the intricacies of blockchain technology and the governance of decentralized financial systems (Choudhury et al., 2019). From a practical perspective, research in this field holds immense relevance for businesses, financial institutions, and the startups themselves. Understanding the dynamics of digital payments is essential for staying competitive in an era where traditional banking models are under threat from innovative fintech disruptors. It allows businesses to adapt to shifting consumer preferences and integrate digital methods into their operations.

The number of incumbent companies at risk due to startups shows a degree of variability, which depends on different influential factors, such as the characteristics and dynamics within each industry, with some sectors proving to be more susceptible than others. Furthermore, the extent of potential disruption brought by startups itself plays a pivotal role, with some innovative ventures orchestrating seismic transformations while others bring about smaller but incremental shifts. Additionally, the evolving landscape of market conditions, such as economic cycles, consumer behavior, and technological advancements, contributes to the changes in the degree of

vulnerability faced by incumbent companies. Startups often pose a risk to established companies, especially when they introduce innovative technologies or business models that challenge the status quo. In highly disrupted industries, such as retail, transportation, and finance, numerous incumbents are facing challenges from startups. In the financial sector, for example, fintech startups have disrupted traditional banking, with a PwC report noting that 88% of traditional financial institutions feel threatened by fintech in 2019 (PwC, 2019). The number of startups worldwide has been steadily increasing over the years. In 2020, there were over 300,000 startups established globally (Statista, 2021). This growth indicates that more companies are entering various sectors, potentially posing challenges to incumbents. Data from Statista from 2021 shows that in the technology sector the combined market capitalization of the top five technology companies, which are Apple, Amazon, Microsoft, Google, and Facebook, was larger than the next 50 companies combined. This dominance showcases the impact of tech giants on incumbent companies but may also leave room for startups to challenge the status quo (Statista, 2021).

In the mobile payments landscape, startups take the role of trusted third-party platform providers for the consumers. By benefiting infrastructures of the banks and mobile carriers, they make different and various solutions available to the consumers. All these solutions were not only aimed at completing the transactions, but also managing finances, making secure investments, safeguarding wealth, and enhancing the overall security of all the relevant processes. This also gave opportunity to several startups to come up with several innovative technologies assisting the user and encouraging them to go cashless without worrying about the lack of privacy or having to deal with a complicated infrastructure.

The COVID 19 pandemic reshaped the landscape of financial transactions and accelerated the development of innovative payment solutions by startups. This crisis acted as a catalyst, forcing fintech startups to find new ways of conducting transactions and reimagining traditional payment methods. The pandemic underlined the need for contactless and digital payment options while highlighting the limitations of existing systems, resulting in a surge of innovation within the fintech industry. The pandemic triggered a surge in demand for digital payments and contactless transactions as consumers and businesses sought to minimize physical interactions and reduce the risk of virus transmission. Research from McKinsey & Company (2020) revealed a significant increase in the use of digital payments during the early months of the pandemic, with 53% of consumers in the United States trying a new digital payment method for the first time. This increase in demand created an ideal environment for

startups to introduce innovative payment solutions. Contactless payments experienced remarkable growth during the pandemic. Startups like Square, which introduced touchless point-of-sale solutions, and mobile payment apps like Apple Pay and Google Pay, gained traction due to their seamless and secure transaction capabilities. Visa's Back to Business Study (2020) found that nearly two-thirds of consumers used contactless payments for in-person purchases.

The pandemic also increased the interest in cryptocurrencies and blockchain technology. With growing economic uncertainties, cryptocurrencies like Bitcoin attracted significant attention as alternative assets which could keep a more stable value over time. Startups like Coinbase and BitPay offered user-friendly platforms for trading and transacting in cryptocurrencies, contributing to the broader adoption of digital currencies (Crunchbase, 2021).

COVID-19 also worsened the situation for some people, especially marginalized communities facing difficulties in accessing financial services. This prompted startups to develop solutions that enhance financial inclusion. Companies like Branch and Tala leveraged mobile technology to provide underserved populations with access to credit and digital financial services, helping to fill the financial inclusion gap (Crunchbase, 2021).

The pandemic also brought regulatory and security concerns to the forefront. As the use of digital payments increased, startups had to explore an evolving and changing regulatory landscape. The need for compliance and security prompted the development of solutions that not only meet regulatory standards but also enhance the overall security of digital payment methods. This is particularly evident in identity verification and fraud prevention, where startups like Jumio and Onfido have made significant steps (Business Wire, 2020).

A report of Deloitte shows how fast the different countries adopted cashless payment system during the pandemic. Asia was the quickest one; although they already had a strong foundation in digital payments, they focused more on enhancing the security and providing a better infrastructure but still faced some restraints due to the interruption in inflow for the start-ups to operate in and the regulatory laws. Then there is South America, which despite facing a severe recession and having increased cybercrimes, they still managed to have a very rapid adaptation to blockchain technologies, allowing startups to provide to the customers varied services despite the reduced margin. Then there are Europe, Middle East and Africa (EMEA), which showed a slower pace of adoption mainly due to the heavy regulatory norms among

them and the major involvement of big organizations allows only little place for the innovative start-ups to represent themselves. North America being next with a slower pace of change adoption from its high focus being on secure processing rather than a complete innovative transformation. Finally, the Oceania, having a severe economic situation slowed down with the complete digitization, even though they had the highest case of Buy now-pay later scheme adoptions. Overall, the whole payments enclosure has taken a major turn, with several new start-ups providing the best of services possible (Deloitte, 2020).

1.4. Startup financing

The entrepreneurial journey of startups encompasses several distinct stages, each representing a pivotal connection from the initial establishment of a startup to its eventual realization of maturity. At every stage of this progression, entrepreneurs encounter a different array of challenges and opportunities, meaning that they will need adaptability, innovation, and strategic decision-making to navigate the complexities of each phase. Their development is divided into five different stages: pre seed and seed stage (concept and product introduction), Round A (growth), Round B and Expansion (Maturity).

In the pre-seed stage, the main sources of fundings come from savings, friends fool and family (FFF), crowdfunding and grants; usually the size of fundings varies between 10.000 and 100.000$ and the revenues generated are null or small. When savings are used to fund the startups, the founders can keep complete ownership, but the risk is high and the fund raising would be meaningless. When the fundings come from FFF it means that they know the founders and they usually don't ask too much for their money; also, founders don't have to provide metrics, business plans and results but they don't offer any additional support. Grants instead are of different nature, they are a way the government funds ideas and projects to provide public services and stimulate the economy, so there is also competition among startups to obtain those funds. The prize can be monetary or non-monetary, such as incubation services, mentoring, and partnerships. The typical size is small-medium: few thousands to some hundreds of thousands of euros, and some of them are in the form of loans with special conditions (longer repayment periods, lower interest rates, etc.). In this stage the main goal is to create a business plan and validate it, create a prototype which can be used to see if it could work. The financial objective is to have a Cash Burn

rate as low as possible and the corporate objective is to conceive and develop the product and test and understand the market. During this founding stage, the development of the idea is elaborated, and the research and development processes are carried out, leveraging on the entrepreneur's own resources and individual capabilities. Creative novelties generate opportunities and create new capabilities while collaborating with other players and stakeholders (Alvarez & Barney, 2013).

Then there is the seed stage, which is where the entrepreneur converts an idea into a business opportunity (Tariq, 2013) and where fundings come from savings, FFF, crowdfunding, and Business Angels. As the European Commission explained, Business angels are often experienced high net-worth individuals, who invest in new or growing businesses individually or as part of a syndicate. They can offer managerial or entrepreneurial support and they have networks, they are much tougher than FFF and an Exit Strategy must be planned out, which is a contingency plan executed by an investor, venture capitalist, or business owner to liquidate a position in a financial asset or dispose of tangible business assets once predetermined criteria have been met or exceeded, as explained by Investopedia. The seizes of fundings range from 500.000 and 1 million $, and revenues are starting to increase a little. The financial objective remains the same while the new corporate objective is to develop the product and match the market. The pre-seed and seed stages are characterized by a huge risk of failure, small funding requirements and negative profits, referred as the valley of death (Salamzadeh & Kesim, 2015).

After the seed stage, the startup enters the Round A stage where the main sources of fundings come from Business angels and venture capitalists' funds, which are whole companies and they have fixed rules to select which investments to make and usually they are valued by their success stories. Most of the startups fail, but few outperform and repay all the other failed investments. They can invest millions of dollars and they become part of the board, and sometimes they assign the CEO role to an experienced manager and not to a founder, especially if they have a technical background. The seizes of the funds received range between 1 million and 5 million $, and revenues are starting to become higher, almost reaching the break-even point. The financial objective is to prove if the revenue model works, while the corporate objective is to find the product-market fit, search of customers, and test the business model. During the growing activities, new ventures accomplish planning, structure, planification, decision-making, coordination, formalism activities, transforming the individual resources of entrepreneurs into organizational resources (Alvarez S. A. & Busenitz L. W., 2001).

Then the startup enters Round B, where the main sources of funds come from Operating Profit and/or Venture Capital Funds and Private Equity. Using the operating profit as a source of fund means reusing the same money received as revenues to invest in that same company. They are not only just creating a positive cash flow to finance themselves, but they are also proving that their business works. Equity, instead, is when the company is giving away part of the ownerships and the founders lose part of the control by selling shares. Their sizes range between 5 and 20 million $ and revenues are high enough to keep the company alive and thriving. The objective in this stage is to reach and surpass the break-even point, keep a high operating profit and scale-up.

The last stage is called Expansion and fundings can come from private equity or through the stock exchange market. Their seizes can surpass 10 million $ and there finally is stabilization of cash flows. The objective here is to increase cash flows, stabilize the company and prepare the exit for early stages investors, ventures, and founders. When the startup reaches the maturity stages, the startup is an established company with clear capabilities and a business model validated (Christensen & Overdorf, 2000).

Investing in new businesses is different from supporting older, established companies. New entrepreneurs often struggle to get funding from banks because they don't have assets or a history of success. Even though their projects might offer high returns, they face challenges due to the higher risk involved.

One more reason why businesses fail is that new entrepreneurs may lack experience in running a business and haven't received proper management training. This can happen even if they have great technical skills. Seeing new business creation as a key driver of innovation, development and employment, regulators constantly stress the need to foster entrepreneurship and their funding (Keuschnigg & Nielsen, Tax Policy, Venture Capital, and Entrepreneurship, 2002).

2 Methodology

The methodology chapter is used as the backbone of this thesis, which provides a systematic framework for the collection and analysis of data gathered. The methodology planning for literature research, data collection and data analysis is an important step to answer precisely to the research questions and it requires specific procedures. At the beginning an overview of the research design is described, highlighting the main research approaches. Once the overall methodological approach is introduced, full details of the data collection and analysis frameworks are proposed.

The chosen approach to carry out this thesis metho is a multi-phase process, which has two main activities. The first one is the literature review which is in chapter 2, the second one is data collection through a census. A third phase, which is not included in the methodology chapter, is data analysis, which will be explained in the following chapter along with the results obtained from the analysis. The methodology is a combination of qualitative and quantitative research. The literature chapter on innovative payments and startups focused on them is described to evaluate all the available research and to determine a topic area (Kitchenham, 2004), which aims at summarizing already existing evidence, identifying possible gaps not filled by previous authors, and reviewing and synthetizing extant literature (Torraco, 2005). The main objective of the literature review is the identification of pertinent materials that supports the research and the presentation of different viewpoints concerning the subject of interest. This process requires the gathering of information that aligns with the research objectives and the examination of a wide array of perspectives related to the subject. The purpose is not just to find data that corresponds with the research, but also to explore a variety of ideas and to expand the scope of the discussion.

After the description and understanding of the topic, in the following paragraphs, the quantitative research method is presented.

The starting point and the primary source of the information is the Crunchbase website, which was used to carry out a census. CrunchBase is a platform for finding business information about private and public companies and it is trusted by over 55 million professionals including investors, salespeople, market researchers and entrepreneurs to detect and connect with innovative businesses and exploit new opportunities (Crunchbase). All the information that can be obtained from this website include investments and funding information, founding members and individuals in

leadership positions, mergers and acquisitions, news, and industry trends. The data provided by Crunchbase, in fact, range from general information such as the birth year of a start-up, description of they do, website, the name, and the surname of the founders. It should be noted that CrunchBase is a public database, which 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 to make sure that all information add up. for example, multiple times it was necessary to look through the actual web portal of several of these startups to get more of an in depth understanding of their actual product offering.

The aim of a census is to provide relevant population data to users in context, but it follows that this data must meet users' expectations in terms of quality, appropriately defined. Hence, the assessment and evaluation of quality in a census is important, primarily in fostering confidence in the data produced by the census but also for planning for future data collection. Further, the management of quality in a census is vital because the census serves as the benchmark for the statistical system. Therefore, the census acts as the baseline for comparison when users go on to collect their own data. The census is also the best, if not the only, source of information on small population groups in terms of area or membership (Baffour et al., 2013).

2.1. Data collection

Crunchbase is a database where all the startups' founders have the possibility of upload information about their companies. This means that in that database hundreds of thousands of different startups can be found. The choice to rely on such an inclusive electronic database has the advantage to gather more information at a worldwide level. Given how enormous the database is, the best strategy was to apply certain constrains to limit the focus of the analysis. To limit the research, some filters can be applied in order to only receive back from the database all those startups that have a matching profile based on the criterions chosen.

The applied search terms on Crunchbase database were chosen according to what was provided by the extant literature and following the guidelines of the Digital Innovation Observatory of Politecnico di Milano. To analyze the international digital payments startups ecosystem 3 different tags have been applied on the Crunchbase Pro research

engine to be maintained in each query: founding date, last funding date, operating status.

- Founding date**:** Founding date limit was set to t01/01/2019. By doing so, all the startups that are founded in the last 5 years will be included in the examination area. This is a prerequisite to have recent companies and consider exclusively startups.
- Last funding date: Last funding date was set to 01/01/2022. By doing so, all the startups that were funded at least once in the last two years will be considered. The reason behind this filter is to make sure that the start-ups are still up and running to their full capacity through their activity with their investors.
- Operating status: To achieve accurate results, startups included in the database had to be operationally active. Thus, all the companies that were closed, merged or left the industry at the time of research, have been eliminated in the primary search.
- Areas of Application: Although implementing all the above-mentioned boundaries enabled the definition of the essential territory of study, the main field is still missing, that is the business area of these startups within the payment industry. Consequently, the following step would be to characterize the desired interest categories that should be investigated.

The research is concentrated on the seven major areas of innovative payments, each having their own sub-categories. The definition of these application areas is provided below.

- Digital Wallet:
    - All-in-one platform: this is a digital wallet which offer multiple services, for example online payments, in-store payments, P2P payments, bill payments, management of loyalty cards.
    - Corporate cards: startups that provide payment cards designed for companies, with the aim of making the management of expenses made by employees on behalf of the company more efficient. These are the cards bearing business information about a company or individual. They are shared during formal introductions as a convenience and a memory aid.
    - Challenger banks: Challenger banks offer many of the same services as traditional high-street banks, including current accounts, savings accounts, credit and debit cards, mortgages, and loans. However, they

usually don't have physical branches, instead focusing on online-first, online banking services through apps. [Beauhurst, 2023]
    - Cashback & rewards: startups which created apps which allow the chance of receiving cashback or other rewards based on the purchases made, like digital loyalty cards.
    - Other
- Payment acceptance:
    - Acceptance: startups which offers different options that allows to accept payments in store and/or online. Acceptance is a mechanism for receiving funds for goods, works or services from the bank cards. This procedure is made by an acquirer bank authorized by the merchant. Acquirer banks use payment terminals linked to their network to accept the payments. For accepting online payments they employ payment gateways
    - Payment gateways: startups that provide services that can be embedded in a company's website to accept online payments. It is a software application that payment service providers use to process payments for online purchases on a merchant's website. It acts as an interface between the merchant's website and a payment processing bank.
    - Mobile ordering: startup which develops solutions to make orders and payments through an app.
    - Recurring payments: startups which develops solutions to manage subscription services with recurring payment. This happens when a merchant automatically charges a customer for goods or services on a prearranged schedule (automated billing, subscriptions, periodic payments).
    - Mobile, Smart and Soft POS: startup which develops different solutions regarding POS, such as mobile POS (wireless POS, they allow direct transactions through the smartphone), Smart POS (electronic credit card reader with a touch screen with hardware and software which enable the possibility to download different apps and functions), and Soft POS (a software or app which thanks to the near field communication NFC enables people to pay digitally through a smartphone or tablet)

    - Smart shop: systems which enable smart/self-check-out in physical stores (such as amazon go and smart cameras)
    - Collection of invoices
- Technological solutions: here there those startups that provide infrastructure or platform to accept and process payments. They address mainly companies, meaning they develop B2B solutions:
    - Cashflow management and/or POS: startups which focuses on developing solutions aimed at allowing the merchants to offer their customers technologically advanced methods of payments and simultaneously help the merchants themselves to have a secure system to store cash experience digital transactions and perform advanced accounting management.
    - Infrastructure: startups providing total infrastructure for the functioning of payment systems and digital solutions to integrate and generate communication within different terminals of operations, unifying relevant systems to function coherently. This also can be a representation of the basic system for the performance of all financial services required in the payments enclosure.
    - Security and privacy: startups providing services for the protection of user data, offering customers enhanced privacy for all their financial operations, assist in secure data transactions and furnish protection against cyber-attacks.
    - Marketplace: marketplace platforms.
- Blockchain:
    - Wallet: startups focused on providing users with an accessible mobile wallet for cryptocurrencies and other associated services. In order to use the cryptocurrencies owned, they have to be stored in a dedicated wallet having its own unique address based on the particular cryptocurrency. These wallets are accessible with a public key and a private key specific to the user allowing them to make transactions using it, which also facilitates payments management between suppliers and customers and provides solutions to transfer of money for specific events. As with any form of currency, peer to peer transactions occur at a noticeably high frequency and that is also another base designed to serve the purpose of exchanging the owned cryptocurrencies among each other.

    - Acceptance: service providers offering solutions for merchants to accept payments with cryptocurrencies and provide retail customer with the technology to perform digital currency transactions payment applications based on Blockchain & Distributed Ledger technologies.
    - Other: other Blockchain & Distributed Ledger based applications focused on payments not classified in the previous sub-categories.
- Sending payments:
    - Managing and payment of invoices: startups providing services to collect invoices and manage their payments.
    - International payments: startup which develops systems to exchange money between different countries.
- Open API:
    - AISP: startup which develops system to access the bank account of their consumers and obtain relevant information and it offers a general overview of their financial situations. The Account Information Service Provider (AISP) allows the customer to manage the information of different bank accounts in a unique online platform. The AISP technology is guaranteed thanks to the PSD2 directive in the European Union.
    - LaaS license as a service: actors who offer services to non-banking companies to operate in the open-banking ecosystem.
    - Open banking platform: startups which develops an Application Programming Interface API for banks and other financial institutions, it enables secure interoperability in the banking industry by allowing third-party payment service and other financial service providers to access banking transactions and other data from banks and financial institutions.
    - PISP: Payment Initiation Service Provider, startups which offer third parties the opportunity to perform a payment transaction on behalf of a buyer, subject to their authorization, without the need for them to visit the bank's online portal.
    - CISP: Card Issuer Service Provider, startups that issue payment cards connected to a different credit institution or bank account. The CISPs do not directly hold client funds but can previously interrogate the bank where the account is active, to verify the availability of the funds involved in the transaction. The CISP technology needs the customer

consensus, and it is provided thanks to the PSD2 directive in the European Union.

- Other: this category includes all the remaining start-ups which work in the payments sector but could not be classified into the previously mentioned categories of operations:
    - Buy now pay later: payment service offered directly at the moment of purchase in order to spread the payment amount in the following months. The amount of money provided is usually low, and it doesn't require any fee.
    - Loans and other financial services: startup which simplifies the process of obtaining loans and similar services, like credit collection, lines of credit and factoring.
    - Digital identity: this service pertains to products which are aimed at allowing the user to store or recognize digital identity. This could be for securing certain operations or for an easy access of all essential details at one point.
    - Donations: platforms dedicated to donations.
    - Wearable: startups dedicated to the development of wearable smart devices which can be used to make payments or similar services.

After classifying startups according to their specific areas of application, another classification was needed, which is based on customer segment typologies towards which each different solution was designed for. This additional layer of categorization further enriches the depth of analysis, facilitating a more comprehensive examination of the startup environment. Consequently, this enables the subsequent classification of the groups of startups into a total of four different categories, as described below:

- **Business to Business** (B2B): A B2B startup focuses on exchanging services, products and information with other companies or startups. They can either cater to another company or directly to a customer, but the focus in this case is only on one layer and hence the focal point sticks to the B2B aspect. These transactions come into play when another business has the need to source materials for the construction of their products, when they require specific services to facilitate their operations, or when they seek assistance in the form of finished products for their own use. This is the functionality layer before every B2C organization.
- **Business to Consumer** (B2C): B2C companies directly provide products and relevant services to the final customers. This is the next layer after a B2B

where the company sells their product to a business and this business then sells that product to the customer at a mark-up. These companies are more towards the downstream and in direct contact with the final consumers.

- **Business to Business to Consumer** (B2B2C): A B2B2C company, as the name indicates, streamlines the methodologies of the previous two categories to create one model of operation where it provides services to a retail client through another business organization. This collaborative process benefits the entities involved due the combination of both the business and the consumer-oriented approach and it allows the organization to cut down on the short comings that would exist while operating separately.
- **Business to Business and Business to Consumer** (B2B & B2C): This category includes all the start-ups that focus on catering to the needs of both, businesses and clients, but without streamlining them to form a combined model. Instead, these companies are serving both the customer groups by benefit from a similar ideology of a B2B and a B2C at the same time with no differentiation.

After a definition of all the different classifications to group together startups and the way the work, it was necessary to setup an excel file in which all the different information would be stored. Thankfully, the Crunchbase website gives the user the option to convert all the different results obtained after the application of the previously explained filters into an excel file. The file obtained had many columns regarding different aspects of those startups that hadn't been used for the analysis of the topic of this thesis. Some of this information are their equity, IPO status, the funding status (in which phase of the different funding stage they are), their social media accounts, acquisition status. All these information is important, but they are not relevant for the scope of this study, so they have not been used. The relevant information that has been essential for this study are: startup's name, the full description of what the focus of the startup is, their website, founding date, last funding date, total funding amount, headquarters' location. Besides the columns with that info provided by the Crunchbase website, more columns have been added to the excel file in order to improve and expand the analysis.

2.2. Analysis procedure

Before starting the analysis on the data, it is necessary to understand the procedure that was followed to perform the study. Extracting relevant data and related categories from Crunchbase is not as easy and simple as it might appear, even a bit challenging, and requires a very careful analysis with some tolerances and a good understanding of how the startups operate and deliver services. Although Crunchbase has a wide selection of criteria to narrow down high-volume search results through keywords, descriptions, and categories, it can still produce erroneous results as users' category entries do not always match the specific ones offered by the site. Some keywords that have been used are Mobile payments, Payments, Transaction processing. After putting in Crunchbase all the criteria mentioned and explained before, the website gave back 2677 startups. Out of all those companies, 1005 have been analyzed the year prior since this kind of analysis is done yearly by the Digital Innovation Observatory of Politecnico di Milano. That means that they had already been categorized based on the classification explained above, therefore it was needed to check if those startups have changed their focus from last year and change the categorization on the excel file accordingly. For what concerns the remaining 1672 startups, they had to be categorized from scratch.

The first analysis was based on the HQ location, so that they can be placed in a specific country and continents. This classification will be useful for the analysis of where the most startups are located. In this way, it is possible to draw a line and understand where most of the innovations in the field of innovative payments is coming from and where different incumbent businesses must be careful about upcoming startups.

The second analysis was based on their focus. Six columns have been added to the excel file to expand the analysis. By reading the description of what they do, it can be understood if they develop products or services that are aimed at one of the categorizations of this study. If the answer is yes, under the first column “in/out of scope” they will be categorized as In. If they develop products or services that have nothing to do with payments, but payments are only mentioned but they are not the main focus, they are categorized as Out.

The rest of the columns are filled out only if the first columns is filled with In scope. The second column is based on the 7 macro-categories which are digital wallet, payment acceptance, sending payments, blockchain, Open API, technological solutions, and others. The third column is the micro-categories, which are different for each macro-category. The fourth column is used for a very brief description about the

focus of the startup. The fifth column is used for the target of the products/services offered. The sixth and last added column is used to write a brief reason for the startups categorized as Out of scope about why they will not be taken in consideration for the analysis.

2.3. Missing information

As previously mentioned, all this information is uploaded by the startups' founders themselves, which sometimes was not enough to continue with the analysis and a cross-checking procedure was needed. But the more difficult aspect was to find the information that was not provided there, such as the information about the operational location or the description of the service provided which was sometimes missing. In other cases, even on 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 regularly update their websites' information. The complications with the data collection were also increased due to the fact that several of these companies did not have a working website.

Another detail to be specified is the issues faced while mapping several companies that originated from the Asia Pacific region, as they had their websites in their own language with little to no information, they were not easily accessible or their website couldn't be translated, which made it difficult to understand what their products/services offered were. To match the information of such companies, it was necessary to look through the internet for relevant articles, the official LinkedIn pages of the company and the founders and even some of their official Twitter pages.

3 Analysis and Results

In the previous chapter, the methodology and the data extraction have been explained. In the following chapter, instead, the detailed analysis of international startup trends on innovative payments will be presented. The objective is to discover ongoing trends, new trends and if there are any fields which are experiencing some sort of decline. The

analysis will be carried out by using pivot tables and graphical representations made with Excel.

The first analysis will be based on the category trends to see which are the most preferred by startups and investors. Then, the focus will shift towards the subcategories, or application, to go deeper into the analysis.

Another interesting perspective would be to focus on the funding that these start-ups have received at an overall level, how having large funds has helped them perform since their introduction to the market and which kind of startups the investors seem to be more interested in.

An additional focus will be based on the targets, as it would help to

understand on what these startups prefer to focus for their products and services.

Another important aspect to analyze is how these startups are distributed globally and which are the focal points in each specific area.

The last focus will be in Italy, in order to see past and present trends in this developed country.

3.1. Category trends

After a thorough analysis of the 2676 startups, 1564 of them were labelled as "Out of scope", meaning that their websites, along with their products and/or services, were analyzed and it was decided that they weren't focusing on innovative payments, leaving them out of scope for the purpose of this analysis. That means that the remaining 1112 startups are the basis on which all the following analysis will be based on. The first analysis is made on the category of the startups.

Category	Number of startups	Percentage
Blockchain	149	13%
Digital Wallet	232	21%
Open API	69	6%
Other	166	15%
Payment Acceptance	214	19%
Sending Payments	103	9%
Technological solutions	179	16%
Total	**1112**	

Table 3. 1 - Startup categories and their numbers

By looking at the results obtained from Table 1, during the years 2019-2023 most of the startups have focused on the Digital Wallet category, with a 21% presence out of all the startups. The reasons for this first place are multiple, some of them are consumer convenience since they offer a convenient and efficient way for consumers to make transactions, mobile penetration since almost everyone owns a mobile phone, the possibility to make contactless payments avoiding disease that can be spread through touch such as COVID19.

Following Digital Wallet there is Payment acceptance, which are startups developing solution to accept payment in different ways and different parts of the world.

To keep up with the evolving world of innovative payments, in order to develop new ways to accept payments, startups must also focus on Technological Solutions to improve the already existing conditions and give to other industries the necessary basis to build new ways to make and accept payments, which is in fact the third highest number of startups.

Then there is the "Other" category, in which it falls all those subcategories which couldn't be placed in other main categories. The number of startups in this category has been growing though the years, especially for the importance of the Buy Now Pay Later movement which will be later analyzed.

The Blockchain category, despite its growing popularity, doesn't come in the top 3 for number of startups. The reason behind its fifth place is because blockchain and crypto values are not used as much in terms of making payments, making them not as popular among people who are looking for new ways to pay. To improve this number, not only people should change their mindset and widen their horizons in terms of payments, but also there should be changes coming for POS and payment acceptance methods.

The "Sending Payments" category only has 9% of the total number of startups around the globe, since it's a very specific category. In this group fall all the kinds of payments which have to do with sending money abroad or invoiced transactions. These two subcategories tighten the possible broad range of startups since they are very specific solutions, attributing to this category only 103 startups.

Open API has the least number of startups, but it's important to notice that it's one of the most recent phenomenon that came out and it has the important role provided by the new legislative regulations such as the PSD2 in the European Union. Another

reason for such a low number is the fact that these startups must meet different regulatory obligations which other categories don't impose on companies.

3.2. Application trends

In this paragraph all the subcategories of each category, which will be called applications, will be explained in order to find out possible trends about fundings and presence.

3.2.1. Blockchain

In Table 2 it is possible to see the details of this category. There is a total of 149 startups focusing on Blockchain and the majority develop products and services relative to the Wallet group. In the Other application there are all those startups which are based in the blockchain world, especially in the payment sector, but it was difficult to find a general application, so it was decided to call it Other. Interestingly, Other received almost three times the total fundings compared to the number of startups in this application, gathering 64% of the total fundings despite only having 23 % of the total number of startups. In fact, the average funding received by a startup focusing on Other is 37 million $, while for a startup focusing Wallet is 7 million $ and for Acceptance is only 3 million $, showing a small interest towards this last application by investors.

Application	Number of startups	Percentage	Total Funding Amount	Percentage	Average Funding Amount
Acceptance	48	32%	$ 139.424.589,00	9%	$ 3.485.614,73
Other	34	23%	$ 977.864.831,00	64%	$ 37.610.185,81
Wallet	67	45%	$ 408.338.221,00	27%	$ 7.291.753,95
Total	**149**	**15%**	**$ 1.525.627.641,00**		**$ 12.505.144,60**

Table 3. 2 - Number of startups, total fundings and average fundings of the Blockchain category

3.2.2. Digital Wallet

In the Digital Wallet category were found a total of 232 startups, divided in the table in Table 3, making it the most famous category out there. The All-in-one platform application received the most attention, with a total of 73 startups to its name, which is the 31 % out of all the startups in this category, followed by Challenger banks with

54 startups and by Cashback & Rewards with 45 startups. This data shows that most customers have already switched to an online form of payments, which doesn't only allow them to make payments, but it allows them to perform different tasks, increasing the usability of such systems. The main reason for such a high amount of startups focusing on this application remains the fact that customers don't have to bring either cash or cards along with them, wherever they go. For what concerns the fundings, Corporate cards shines brighter than the other application, receiving 58% of the total fundings despite only having 15% of the total startups, averaging 90 million $ per startup, which can be explained by the fact that it helps companies to provide their employees with smarter finance management and greater rewards. Challenger Banks received 8% of the total fundings even though they have 23% of the startups. Similar results can be found for the other applications, which all received less fundings compared to the number of startups they have, since Corporate Cards received more than half of the total fundings. Cashback & rewards is aligned with the other applications for presence of startups and fundings received, but it doesn't get much more attention than other applications because their main focus is making payments through a system, which then rewards you with a small percentage of cashback or similar rewards, but customers mainly see the new payment method which is already available through so many other applications.

Application	Number of startups	Percentage	Total Funding Amount	Percentage	Average Funding Amount
All-in-one platform	73	31%	$ 1.009.960.626,00	20%	$ 16.556.731,57
Cashback & Rewards	45	19%	$ 611.127.473,00	12%	$ 16.082.301,92
Challenger Banks	54	23%	$ 405.880.067,00	8%	$ 9.019.557,04
Corporate Cards	34	15%	$ 2.900.582.244,00	58%	$ 90.643.195,04
Other	26	11%	$ 41.096.661,00	1%	$ 2.739.777,40
Total	**149**		**$ 4.968.647.071,00**		**$ 26.013.859,01**

Table 3. 3 - Number of startups, total fundings and average fundings of the Mobile Wallet category

3.2.3. Open API

As it was said before, Open API is a pretty recent phenomenon and startups focusing on this sector would also need to collaborate with banking services, which explains the lower number of startups compared to other categories, as shown in Table 4. License-as-a-service, also called Laas, seems to be the most interesting application for startups,

obtaining the 31% of all startups out of all the 5 applications, followed by Open banking platform with 23% and AISP with 21%. For what concerns the amount of fundings received, Laas obtained the most but in comparison, CISP startups, also known as Card Issuer Service Provider, received the highest average, standing on top with 92 million $ compared to the 26 million $ of Laas. The high average for CISP is due to the fundings received by three startups, which they all received more 104 million €, while the fourth one only 15 million and the fifth one didn't disclose how many fundings they obtained. The other three categories, despite having 62% of the total number of startups, only collected 21% of the total fundings and they have averages below 7 million $.

Application	Number of startups	Percentage	Total Funding Amount	Percentage	Average Funding Amount
AISP	14	21%	$ 62.514.327,00	6%	$ 4.836.703,8857
CISP	5	7%	$ 369.725.000,00	33%	$ 92.431.250,00
Laas	21	31%	$ 499,747,135,00	45%	$ 26.302.480,79
Open Banking Platform	16	23%	$ 104,831,118,00	9%	$ 7.487.937,00
PISP	12	18%	$ 67.015.147,00	6%	$ 6.701.514,00
Total	**69**		**$ 1.525.627.641,00**		**$ 18.119.928,44**

Table 3. 4 - Number of startups, total fundings and average fundings of the Open API category

3.2.4. Other

In the Other category were placed all those applications that were too general to be placed in the main categories. Here, in Table 5, the two main applications are Loans and other financial services and Buy Now Pay Later, which together account for 81% for the startups in this category and 99% of the total fundings received. Wearable, Donations and Digital Identity only received 1% of the fundings despite having 19% of the total startups. This shows that investors are not fully aware of these smaller applications, or they don't believe that they are going to succeed yet. Especially Wearable devices and Digital Identity are topics that only came out recently and they are still under development, or they are already developed but they are not used as much by organizations and consumers, leaving investors no other choices but to invest in other applications.

Application	Number of startups	Percentage	Total Funding Amount	Percentage	Average Funding Amount
Buy Now Pay Later	56	34%	$ 3.830.489.544,00	68%	$ 75.107.638,12
Digital Identity	17	10%	$ 46.960.132,00	0%	$ 3.354.295,14
Donations	14	8%	$ 12.272.067,00	1%	$ 1.115.642,45
Loans and other financial services	78	47%	$ 1.763.231.457,00	31%	$ 26.715.628,14
Wearable	1	1%	$ 1.818.560,00	0%	$ 1.818.560,00
Total	**166**		**$ 1.525.627.641,00**		**$ 39.543.858,46**

Table 3. 5 - Number of startups, total fundings and average fundings of the Other category

3.2.5. Payment Acceptance

In this group there are 7 different applications which all converge on making products and services to facilitate acceptance of payments, as it can be seen in Table 6. The most present application is Acceptance with 37% of startups and 34% of fundings received, followed by Payment Gateways with 18% of startups and 43% of fundings received, by Mobile ordering with 14% of startups and 9% of fundings, and by Collection of invoices with 14% of startups and 8% of fundings. In this category can also be found Smart shop, which are new ways of doing grocery shopping that allow the consumer to make purchases by just, for example, walking out of the store. It still is a work in progress, there are a few operating stores in the USA, but they are not very popular yet, even though they are a great idea to simplify the consumer's life. Besides Acceptance and Payment Gateways, all the other applications have received less than 10% of total fundings each, making the average lower than 9 million $ per startup. The same thing can be said for the Mobile, Smart and Soft POS since it only has 12 startups, based on new ways of accepting payments towards which people are yet not used to, making it a little uninteresting, even though it is promised to have an important rise.

Application	Number of startups	Percentage	Total Funding Amount	Percentage	Average Funding Amount
Acceptance	80	37%	$ 774.204.458,00	34%	$ 12.096.944,66
Collection of invoices	29	14%	$ 173.194.334,00	8%	$ 8.659.716,70
Mobile Ordering	30	14%	$ 196.708.609,00	9%	$ 6.783.055,48
Mobile, Smart and Soft POS	12	6%	$ 88.681.628,00	4%	$ 7.390.135,00
Payment Gateways	39	18%	$ 971.519.354,00	43%	$ 27.757.695,83
Recurring Payment	22	10%	$ 67.698.571,00	3%	$ 4.231.160,69
Smartr Shop	2	1%	$ 9.276.063,00	0%	$ 4.638.031,50
Total	**214**		**$ 2.272.293.017,00**		**$ 12.816.196,72**

Table 3. 6 - Number of startups, total fundings and average fundings of the Payment Acceptance category

3.2.6. Sending Payments

In the Sending Payments category there are only 2 applications: international payments, which are basically cross-border payment, and managing and payment of invoices. These two applications are evenly distributed, the first with 49 startups and the second with 57 startups, but International Payments received 72% of the total fundings, while managing and payments of invoices only 28%.

Application	Number of startups	Percentage	Total Funding Amount	Percentage	Average Funding Amount
International Payments	49	46%	$ 634.195.239,00	72%	$ 16.261.416,38
Managing and payment of invoices	57	54%	$ 244.898.511,00	28%	$ 5.323.880,67
Total	**106**		**$ 878.933.750,00**		**$ 10.342.279,41**

Table 3. 7 - Number of startups, total fundings and average fundings of the Sending Payments category

3.2.7. Technological Solutions

In the last category there are 176 startups and 45% of them are based on Cashflow management, followed by Infrastructure with 26%, Security & Privacy with 19% and Marketplace with 10%. The high number of startups obtained by Cashflow Management is due to the products and services they develop that allow other businesses to manage their payments in ways that are different than before. The Security and Privacy applications has been stable for some years, even though there will always be customers who are afraid of their personal information being leaked online after they make payments different from the traditional cash and these applications can only make them feel safer. Marketplace, instead, is at the last position of the list not because of their low usefulness, but probably because the services offered by those startups might be very focused, attracting not many customers, and there are big marketplaces out there which already offer a wide range of products and services attracting even more customers. Even the fundings are equally distributed based on those same percentages, even if Cashflow management takes 71% of the fundings.

Application	Number of startups	Percentage	Total Funding Amount	Percentage	Average Funding Amount
Cashflow management	80	45%	$ 2.226.592.532,00	71%	$ 32.744.007,82
Infrastructure	45	26%	$ 525.699.584,00	17%	$ 14.208.096,86
Marketplace	18	10%	$ 131.545.609,00	4%	$ 10.118.893,00
Security and Privacy	33	19%	$ 268.630.849,00	9%	$ 11.192.952,04
Total	**176**		**$ 3.152.468.574,00**		**$ 22.200.482,92**

Table 3. 8 - Number of startups, total fundings and average fundings of the Technological Solutions category

3.3. Funding trends

Another important analysis to make is based on how the investors around the world decided to fund those startups. Some startups didn't disclose the fundings they received, otherwise the total amount of fundings would be even higher.

Category	Total Funding Amount	Percentage
Blockchain	$ 1.525.627.641	8%
Digital Wallet	$ 4.968.647.071	25%
Open API	$ 1.105.315.635	6%
Other	$ 5.654.771.760	29%
Payment Acceptance	$ 2.272.293.017	12%
Sending Payments	$ 829.564.348	4%
Technological solutions	$ 3.210.987.976	16%
Total	**$ 19.567.207.448**	

Table 3. 9 - Total amount of fundings distributed among the categories

From the year 2019, the total amount of fundings received is equal to almost 20 billion $, which has been divided accordingly to seven categories in Table 9. The category

with the highest funding received, surprisingly, is Other, which contains startups based on loans, buy now pay later and other financial services, donations and wearable devices. Just a few years ago, the percentage of fundings received by this category was less than 10% of the total. Although in this category only 15% of the total startups can be found, they received 29% of the total funds. The second and third category with most fundings are Digital wallet and Technological solutions, which follow the same order of the classification in Table 1.

Table 10 shows instead the top 6 subcategories which received the most fundings. This shows especially how much fundings the subcategory "Buy Now Pay Later" obtained, with many startups surpassing the 100 million $ in fundings received.

Other – Buy Now Pay Later	$	3.380.489.544
Digital Wallet – Corporate Cards	$	2.900.582.244
Technological Solutions – Cashflow Management	$	2.226.592.532
Other – Loans and other financial services	$	1.763.231.457
Digital Wallet – All-in-one platform	$	1.009.960.626
Blockchain - Other	$	977.864.831

Table 3. 10 - Top 6 subcategories with the highest fundings received

To better understand how those fundings are distributed among those startups, the average funding can be analyzed for each category and subcategory as well by looking at Table 11.

Category	**Average Funding Amount**	
Blockchain	$	12.505.144,00
Digital Wallet	$	26.013.859,00
Open API	$	18.119.928,00
Other	$	39.543.858,00
Payment Acceptance	$	12.765.691,00
Sending Payments	$	10.116.638,00
Technological solutions	$	22.144.744,00
Total	**$**	**21.222.567,00**

Table 3. 11 – Average Funding for each startup in each category

The average fundings received for each startup in each category in the previous table shows an evident gap between the first place, which is still Other, the second place obtained by Digital wallet with a difference of 13 million $ of funding received by each

single startup, and the third place where Technological Solutions can be found, with 22 million $ of fundings raised per single startup.

A similar analysis can be made on the subcategories, in order to see which are actually the most interesting subcategories on which investors prefer to invest more money.

Open API - CISP	$	92.431.250
Digital Wallet – Corporate Cards	$	90.643.195
Other – Buy Now Pay Later	$	75.107.638
Blockchain - Other	$	37.610.186
Technological Solutions – Cashflow Management	$	32.744.008
Payment Acceptance – Payment gateways	$	27.757.696

Table 3. 12 - Subcategories with the highest average fundings

Table 12 shows three categories that were in lower position in the previous analysis, which are Open API, Blockchain and Payment Acceptance. CISP, which stands for Card Issuer Service Provider, isn't a popular focus for startups since there are only 5 startups in the database and one of them didn't disclose their fundings, but the reason why they were able to collect so many fundings is because their services and products can considerably improve the consumers' user experience, who can access new financial and payment services through channels other than banking ones.

For what concerns Blockchain – Other, here there are startups that develop products and services concerning the world of Blockchain which has become more popular since 2018 and more people every year are jumping into this new way of making payments.

In Table 13 there are shown the 10 startups which received the most fundings during the last 5 years.

Name	Category	Subcategory	Target	Total Funding Amount
Ramp	Digital Wallet	Corporate Cards	B2B	$ 1.367.000.000,00
Tabby	Other	BNPL	B2C	$ 740.595.314,00
Scalapay	Other	BNPL	B2B & B2C	$ 727.479.971,00
Moonpay	Blockchain	Other	B2B & B2C	$ 647.678.231,00
Atome	Other	BNPL	B2B2C	$ 645.000.000,00
Xepellin	Technological Solutions	Cashflow Management	B2B	$ 567.000.000,00
Settle	Technological Solutions	Cashflow Management	B2B & B2C	$ 520.999.750,00
Remote	Sending Payments	International Payments	B2B	$ 496.000.000,00
Balance	Payment Acceptance	Payment Gateways	B2B	$ 431.000.000,00
Ratio	Other	BNPL	B2B	$ 415.300.000,00

Table 3. 13 - Startups with highest fundings received

This ranking is very useful to represent the businesses that received the most funding and attention from investors. The ten startups received in total more than 6.5 billion $, which is one third of the total fundings received by all the startups analyzed "in scope". Ramp has an outstanding performance, receiving more than USD 1 billion $, and it is classified in the Digital Wallet providing corporate cards. Four out of ten of these startups are focused on Buy Now Pay Later, which is the first subcategory with the highest fundings collected and the third subcategory with the highest average fundings collected. Another interesting aspect is that six categories are present in this list, while Open API is not. The startup with the most fundings received from Open API category "only" has 169.6 million $, a much lower amount compared to the last position in this top 10.

3.4. Target trends

Another analysis can be drawn out by looking at the targets. In Figure 8, eight out of these ten startups decided to focus on B2B, which is the sector on which most of the startups decided to focus, as it can be seen from Table 14.

Target	Number of startups	Percentage
B2B	537	48%
B2C	360	32%
B2B2C	127	11%
B2B & B2C	88	8%
Total	**1112**	

Table 3. 14 - Distribution of the startups based on their targets

Most of the startups prefer to focus on one single group of clients, which is either another business or the final customer, since these two targets account for 80% of the total, while only 19% of them prefer to focus on both groups. By looking at figure 8, eight out of ten startups focused on B2B, five of which solely on them and three of which focused on other targets as well. B2B received the attention from 48% of the startups since most businesses are interested in advanced payment technologies. The next in line is B2C, since after focusing on businesses, startups must also focus on the final customers. The most interesting target areas are B2B2C and B2B & B2C. These targets only received 19% of the startups attention because to develop products and services which focus on both other businesses and the final customer can take much more time and resources, which sometimes startups don't have straight away from their founding date.

Target	Total Funding Amount	Percentage
B2B	$ 10.551.222.025,00	54%
B2C	$ 3.911.562.305,00	20%
B2B2C	$ 2.217.329.607,00	11%
B2B & B2C	$ 2.887.093.511,00	15%
Total	**$ 19.567.207.448,00**	

Table 3. 15 - Distribution of the fundings based on the targets

Another analysis can be drawn out from a look at the targets. By looking at Table 15 the amount of fundings received respect the same percentages of the previous analysis, although those startups that focused on B2B & B2C obtained more money in comparison with those who focused on only B2C, despite the fact that B2C startups are 4 times more than B2B & B2C startups. This detail can be better seen by looking at

Table 16, where there are the average fundings received based on targets. By looking at this table it's clear that startups which focused on B2B & B2C received so much more money compared to the other targets.

Target	Average Funding Amount	
B2B	$	23.343.411
B2C	$	13.395.761
B2B2C	$	20.722.706
B2B & B2C	$	41.793.384
Total	**$**	**21.222.567**

Table 3. 16 - Average fundings received by startups based on targets

Table 17 shows the distribution of the number of startups based on categories and targets. The three most impressive number to focus on are Digital Wallet – B2C, Payment Acceptance – B2B and Technological Solutions B2B, which have more than 100 startups per group.

Digital Wallet – B2C has a high number because the main focus of this category is the final customers, as they try to develop products and services which can make their life easier and faster. As it was said at the beginning of this chapter, the reason behind the high number of startups in Technological Solutions which focus on B2B is because they mainly develop product and services that will become the basis from which other companies will develop other products and services destined to the final consumers. In fact, only 15 startups from the Technological Solutions category focused on B2C solutions.

For the same reason, Payment Acceptance startups develop products which can be used especially by other companies to be implemented in their businesses.

The Blockchain group has lots of startups focusing on both targets separately. This is because as 70 startups develop new ways for consumers to make payments, 52 other startups have to develop new ways for businesses to accept those new payments.

For what concerns the Sending Payments category, it has 61 startups focusing on B2B as they develop products to better manage invoices of companies, while other startups focus on making it easier for people to make payments to other countries.

For the Other category, since it has different subcategories with different objectives, it is normal to have a similar number of startups focusing on all targets.

Finally, the Open API category mainly focus on businesses, as it can be seen from the 43 startups on B2B compared to the 11 startups on B2C.

	B2B	B2C	B2B & B2C	B2B2C
Blockchain	52	70	11	7
Digital Wallet	76	108	25	23
Open API	43	11	4	11
Other	56	67	21	22
Payment Acceptance	109	46	10	49
Sending Payments	61	34	6	2
Technological solutions	140	15	9	15

Table 3. 17 - Distribution of the startups based on category and targets

In Graph 1 instead there is the graphical representation of the same data proposed in Figure 10, which gives a better representation of the gap created by the groups with more than 100 startups compared and the other groups with a smaller number.

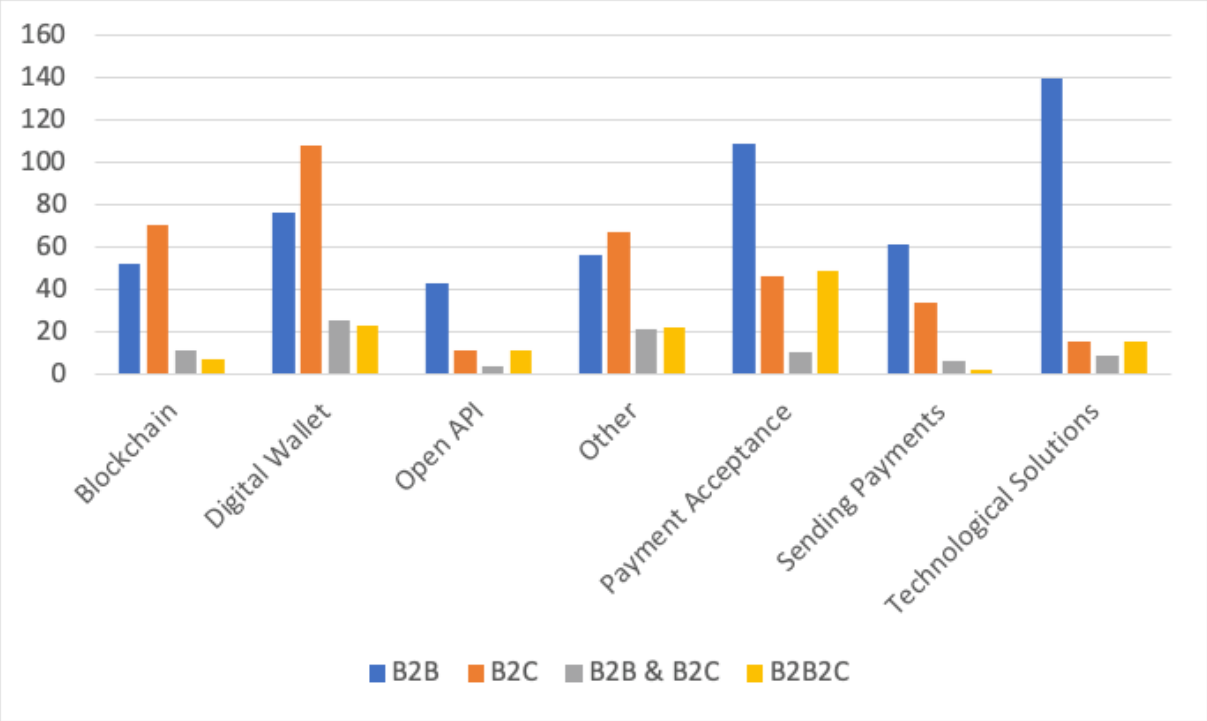

Figure 3.1 - Graphical distribution of the startups based on category and targets

3.5. Geographical trends

In this paragraph the analysis based on the geographical distribution of these startups will be carried out. Out of the 1112 "In scope" startups, 20 of them didn't disclose their current location, which means that the database for this analysis will be based on 1092 startups.

Graph 2 shows the concentration of the startups around the continents: blue means there is a high concentration, while grey and light blue means there is a small number of companies. There is at least one startup in each continent (Antarctica excluded, for obvious reasons) and in 91 countries, with USA being the country with the most startups, surpassing 360.

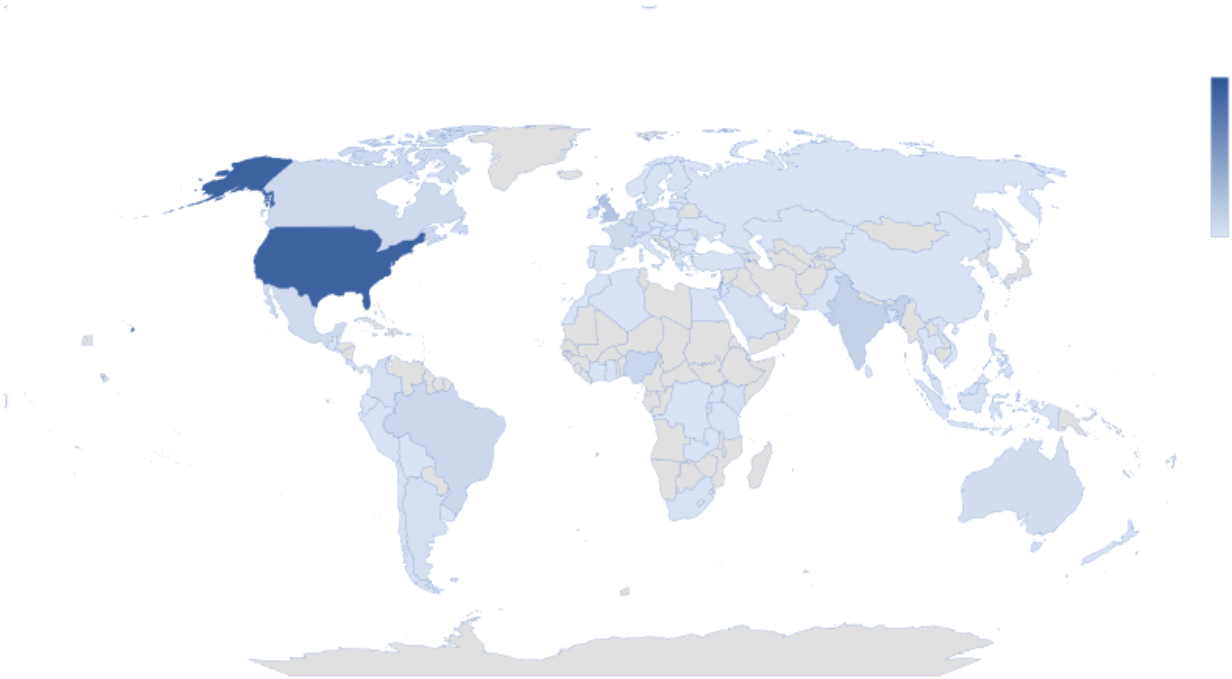

Figure 3.2 - Distribution of the 1092 In-Scope startups

Table 18 shows how these 1092 startups are distributed among the 6 continents. North America is at the top of the list with 405, mainly thanks to the USA, which have 367 startups alone. The second place is taken by Europe with 275, where the distribution is more homogeneous compared to North America, meaning that all countries, except the UK being the European leader, have a similar number of startups. Then in third place comes Asia with 204 startups, mainly thanks to a few countries. The fact that

Asia only comes at the third place can be explained by looking at the Crunchbase website, which is American. This means that not everyone in Asia probably knows the existence of such website, leaving many startups in the shadow. This can also be seen by looking at China, which is the country it was expected to come at the top, instead there are only 2 startups which were born there between 2019 and 2023. Then there are America Latina and Africa, with a similar number of startups, since they have many countries which are still developing.

Continent	Number of startups	Percentage
Africa	89	8%
America Latina	100	9%
Asia	204	19%
Europe	275	25%
North America	405	37%
Oceania	19	2%
Total	**1092**	

Table 3. 18 - Distribution of the startups by continent

Table 19 shows instead the top 10 countries with most startups. Once again, USA takes the first place with the most startups. It's interesting to note that developed European countries such as Italy, Spain and Switzerland barely surpass the 10 startups mark per country, leaving them out of this ranking.

Country	Number of startups	Percentage
USA	367	34%
UK	91	8%
India	53	5%
Singapore	45	4%
Nigeria	38	3%
Brazil	35	3%
France	30	3%
Canada	29	3%
Mexico	26	2%
Germany	24	2%
United Arab Emirates	24	2%

Table 3. 19 - Top 10 countries with most startups

In Graph 3 it is possible to see a different kind of analysis. It is shown the trend of the birth of new startup in each year, from 2019 to 2023. Until 2021, it's pretty obvious that there is a growth from all the six continents. In 2022 there is decline in the growth of new startups. 2023, instead, shows a drastic decline. The reasons for this decline are multiple and they don't have to do with a decline in the interest towards these topics. This database was extracted from Crunchbase around July 2023, meaning that there still were 6 months in 2023 for startups to be created. Also, it must be taken into consideration the fact that Crunchbase only shows the information that were published by the founders of those startups. If they didn't publish anything, nothing would come up on the website. This means that there might be even more startups created in 2022 and 2023, but the founders haven't used the Crunchbase website yet. It is most likely since it' been one year and a half from the start of 2022 and most funders probably focused on other more important aspect instead of "listing" their company on the website. It is believed that if this kind of research is repeated in a year, much more startups would appear on the website and increase the growth columns of 2022 and 2023 in Graph 3. For this exact reason, it would have been useful to make an analysis on 2023 trends, which categories were chosen the most by new startups, which startups were funded the most, which continent funded the most and other similar observations, but given the fact that from Crunchbase only 19 startups were born during this year and the fact that there still is half a year in which investors can fund companies makes it impossible to do such analysis, or, if not impossible, incomplete.

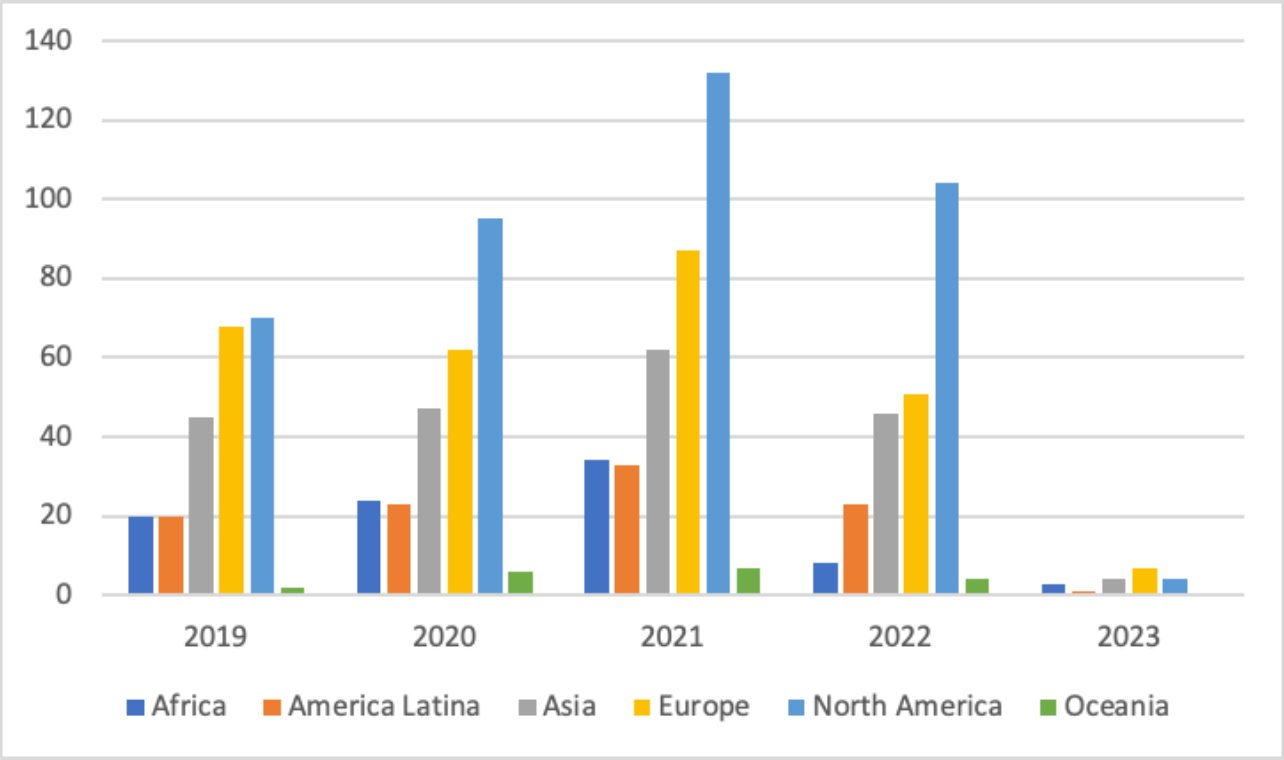

Figure 3.3 - Distribution of the growth of startups throughout the 5 years span

In Table 20 it can be seen the distribution of the startups based on continents and on categories. What peaks from this table is a few percentages, for example the fact that 27% of startups in Africa focus on Digital Wallet, especially All-in-one Platform and Challenger banks, which is the highest percentage for this category among the six continents. This number is followed by Asia, where there are many startups focusing on All-in-one Platform, which is the continent where most of these Super Apps have had the most impact on the population. A few examples are WeChat, AliPay, Paytm, Gojek and Grab. Another aspect to notice is the leadership of Europe on Open API, since this is a movement which was developed in England recently. For what concerns Payment Acceptance, Africa and America Latina have the most average especially for Buy Now Pay Later and Loans and other financial services. These two continents have many countries which are still developing, and they may benefit from having different services which allow their final consumers to access different forms of payments, from accessing loans to paying in installments.

Oceania only has 19 startups, a low number which isn't high enough to understand correctly the average categories s on which they focus on.

	Blockchain	Digital Wallet	Open API	Other	Payment Acceptance	Sending Payments	Technological solutions	Total
Africa	8%	27%	4%	20%	16%	9%	16%	89
America Latina	7%	17%	9%	19%	21%	12%	15%	100
Asia	14%	25%	3%	16%	19%	7%	15%	204
Europe	13%	20%	11%	13%	18%	10%	15%	275
North America	15%	19%	5%	13%	20%	10%	18%	405
Oceania	21%	21%	5%	11%	37%	0%	5%	19

Table 3. 20 - Distribution of the startups based on categories and continents

Table 21 instead, similar to Table 20, shows the distribution of targets based on the continents. This table doesn't show any particularity, since almost all of the percentages seem to be aligned between them. At a first glance, B2B seems to be the main interest for almost half of the startups of each continent, besides Oceania which only has 32% of the startups focusing on B2B. The other majority of the remaining percentages is taken by the focus on B2C, which ranges between 26 and 37%. The other two main targets, B2B2C and B2B & B2C, range between 5 and 18 %, showing a smaller interest since these targets are more complicated than focusing on a single target.

	B2B	B2C	B2B & B2C	B2B2C	Total
Africa	44%	31%	12%	11%	89
America Latina	50%	6%	18%	6%	100
Asia	45%	37%	10%	8%	204
Europe	53%	27%	12%	7%	275
North America	49%	34%	9%	8%	405
Oceania	32%	53%	11%	5%	19

Table 3. 21 - Distribution of the startups based on targets and continents

Table 22 shows how the fundings received are distributed among the six continents. 3 continents gathered 85% of the total fundings and these are North America, Asia and Europe. North America, despite having 37% of the total number startups in the world, received almost 50% of the total fundings. Another interesting aspect is the fact that Europe received less fundings compared to America Latina, Asia and Oceania. This can be seen by looking at the average funding received per startup, and Europe received 12 million $ per startup while America Latina, Asia and Oceania received respectively 28 million, 25 million and 16 million $, showing a lack of interest coming

from European investors towards this kind of startups. This is a huge improvement especially for America Latina, where most of its countries are still developing but they received lots of fundings anyway. Africa, instead, received much less fundings compared to other continents. They have 8% of the total startups but only received 1% of the total fundings.

Continent	Total Funding Amount	Percentage	Average Funding Amount
Africa	$ 208.720.693,00	1%	$ 2.782.942
America Latina	$ 2.365.259.072,00	12%	$ 28.276.893
Asia	$ 4.048.926.845,00	21%	$ 25.148.613
Europe	$ 2.979.663.253,00	15%	$ 12.843.376
North America	$ 9.665.663.462,00	49%	$ 28.345.376
Oceania	$ 266.556.880,00	1%	$ 16.659.805
Total	**$ 19.567.448,00**		

Table 3. 22 - Funding distribution among continents

In Table 23 it can be observed the top 10 countries which received the most funds. Obviously, as observed before, USA takes the first place with 9.4 billion $. The second place is taken by Mexico with more than 1.3 billion $, followed by Singapore with almost 1 billion $. Along with Mexico, other surprises in this list are Brazil at the fifth place 791 million $, Israel at the sixth place with 762 million $ and India at the ninth place with 586 million $. For what concerns the average of fundings received by a single startup, Italy takes the first place with 105 million $, all thanks to one startup out of seven which received more than 700 million $, followed by Israel with 69 million $ and by Mexico with 64 million $. UK, despite being the second country with the most startups, has the lowest average in this list, not even reaching the 10 million $ mark.

Country	Total Funding Amount	Number of startups	Average Funding Amount
USA	$ 9.400.361.142,00	367	$ 30.421.880
Mexico	$ 1.351.400.977,00	26	$ 64.352.427
Singapore	$ 995.377.465,00	45	$ 24.884.436
United Arab Emirates	$ 884.753.116,00	24	$ 49.152.950
Brazil	$ 791.353.907,00	35	$ 28.262.639
Israel	$ 762.015.333,00	13	$ 69.274.121
Italy	$ 735.243.207,00	7	$ 105.034.743
UK	$ 688.431.150,00	91	$ 9.430.563
India	$ 586.837.222,00	53	$ 14.313.102
Germany	$ 497.165.974,00	24	$ 24.858.298

Table 3. 23 - Top 10 countries which received most funds

3.6. Focus on Italy

In the previous section of this chapter a detailed and thorough analysis has been done regarding the geographical distribution, the targets, the main categories, and the amount of fundings received by the startups taken into consideration. Now the focus will be briefly shifted towards Italy, the country in which the Innovative Payments Observatory of Politecnico di Milano reside, which has collected many information and documents that have been used to make this analysis.

In Table 24 has been collected all the Italian startups, they are only seven, so it was possible to make a focus on the entire group. With only 7 startups in this territory, it was not possible for Italy to shine enough for what concerns the amount of fundings received and number of startups. Among these few startups though, there is one that shines bright enough to appear in the top 10 of the most funded startups in the world, which is Scalapay. In fact, thanks to its large base of fundings, it highly increases the average of fundings received per startup, making italy become the country with the highest average in the world.

An important aspect is based on the category, which shows that the two preferred ones are Other and Payment Acceptance. Another detail is based instead on the target, where five startups focus solely on B2B, one solely on B2C and the last one on both.

Name	Category	Subcategory	Target	Total Funding Amount
Scalapay	Other	BNPL	B2B & B2C	$ 727.479.971,00
Glassfy	Payment Acceptance	Recurring Payments	B2B	$ 3.164.637,00
Qodeup	Payment Acceptance	Mobile Ordering	B2B	$ 2.733.165,00
VoiceMe	Other	Digital Identity	B2C	$ 664.364,00
FlowPay	Open API	Laas	B2B	$ 51.353,00
FidoRent	Other	Loans and other financial services	B2B	$ 413.803,00
CyLock	Technological Solutions	Security and Privacy	B2B	$ 335.914,00

Table 3. 24 - List of the Italian startups

Although there are only 7 startups which came out from the Crunchbase website, that doesn't mean that there are effectively only seven. After a few research, other startups came up and they will be talked about briefly in the following paragraphs. This goes to show that just because Crunchbase revealed a certain number of startups, it's likely that there are even more out there which weren't put on the website for different reasons.

The first startups that came up was Cents, an innovative idea of ethic marketing where businesses could devolve part of their transactions as donations towards nonprofit organizations. It's a good idea for businesses which want to show the way they are working while they promote their products and services. If it had to be put under a category, it would be Other – Donations.

Another startup is Lendit, which was founded in 2023 and received around 100,000 € so far. Basically they are changing the way companies can access credit lines. This credit-sharing platform provides a simple, fast, and tailored option for lending and requesting liquidity. The Lendit community can also rely on a loyalty plan, Lendit-score, and a proprietary guarantee fund, ensuring security for both lenders and borrowers. If it had to be put under a category, it would be Other – Loans and other financial services.

In 2019 Pinv was founded, which is a startup that offer an efficient way to manage cashflows for self-employed and micro-companies. They built a cloud platform which allows for easy monitoring of cash flow, management of receipts and payment reminders, and anticipation of liquidity issues. With the integration of current accounts and the option to link the tax drawer, Pinv simplifies the financial life of professionals and SMEs, becoming an excellent choice for those seeking agile and accessible solutions. If it had to be put under a category, it would be Technological solutions – Cashflow management.

Another startups similar to Pinv is Sibill, which developed a cloud platform that connects various bank current accounts, automates cash forecasts, and simplifies payments. This solution helps businesses have more organized information, faster accounting, and real-time updated cash flows. If it had to be put under a category, it would be Technological solutions – Cashflow management.

VoiceMe developed a platform based on 5-factor authentications that allows customers to access digital properties, make payments and peer-to-peer transfers, sign documents, access restricted physical areas, and confirm actions and identities through voice OTP. If it had to be put under a category, it would be Technological solutions – Security and Privacy.

Another important Italian startup is Qomodo, which received 34.5 million $ as soon as it was born, becoming the Italian startup with the highest first funding round. What the company does is offering a Buy Now Pay Later service, but it is accessible only in specific events, those called “emergencies”. With emergencies they refer to the car breaking down, replacing a rotten tooth, and similar events. Qomodo then gets in contact with them and offer their way to pay in installments without interest to the merchants. they explained that emergency payments are around 1000€, which is ten times higher than the average payments done with Buy Now Pay Later services, as explained by the Italian journal La Repubblica.

4 Conclusion and future developments

In the following paragraph, the main findings from the analysis and the literature review are presented, along with limitations and recommendations for future research.

In the last few years startups have been growing at a steady and increasing pace, showing a keen interest in the innovative payment topic. According to the results obtained, it can be concluded that innovative payments are becoming more and more part of the way people spend their money daily, reducing the differences between "online and offline" payments. Even though so far physical cards, such as credit and debit cards, still hold their fair share of usage in payments, mobile wallets are catching up if not leading the way in some countries. There are even some companies that are developing new ways to make new customer join the Mobile wallet trends, such as loyalty programs, rewards and all-in-one platform with which the consumer can do a bunch of things from the same application, such as ordering a taxi or paying for bills. But as consumer find new ways to make purchases, startups find ways to attract other businesses with advanced systems to accept payments, which can either be one-time or recurring payments. Similar to making payments, sending money abroad or paying for products that are being sold in a different country which only accepts a specific currency is becoming a new focus as well. In order to develop new ways of making and accepting payments, the technological foundation at the basis of both services must change, and here is where some startups come into play offering technological solutions about cashflow management and payment infrastructures. For what concerns financial services, these last few years there have been many fundings sent towards startups focusing on Buy Now Pay Later, Loans and other financial services. Consumers like to use these kinds of financial services not to empty their wallet completely right away after a big purchase. In this way they can also better manage their financials decisions and they don't feel the stress when incurring in big medical payments, knowing they can rely on these kinds of services. Another improvement coming from the financial side is based on open banking, which offers new banking

services mostly based on data. On a completely different note, there is the blockchain world, still relatively new but also very much advanced already, it's still trying to find its way through the everyday life of people and startups are now trying to implement it into payments, offering new services and products to make life easier and more smoothly.

From the analysis there are a few aspects that stand out. The first thing is that the Digital Wallet category is the one with the most startups, reaching a total of 232 and 21% of the total number of startups in the world. This number increased especially after covid19, as they develop new ways of making payments by not using cash or cards, which can transmit bacteria and viruses. The category with the most fundings received is instead Other, with more than 5.6 billion $ and 29% of the total, even though they only have 15% of the startups. The two subcategory which participated the most in achieving this result are Loans & other financial services and Buy Now Pay Later; they are both services aimed at alleviating the life of consumers who have to spend big amount of money and they don't want to feel the pressure of paying it all at once. The highest average of funding received based on subcategories can be found in Open API – CISP, averaging a total higher than 90 million $ per startup. This high number shows the interest from investors towards this relatively new topic in the world of open banking. For what concerns the geographical distribution, North America stands out with the most startups, all thanks to the USA, the country with the highest number of startups, achieving a total of 367 startups, followed by the UK with 91. Lastly, after focusing on Italy it was clear that they don't seem to have lots of startups. From the CrunchBase website only 7 came up but after a few research 7 more were found.

The world of innovative payments is getting more advanced by the seconds and to keep up with such speed it's important to have all parties involved on board and create a platform of general collaboration.

This census can be the basis for future studies and the starting point for an analysis based on more years, as most of the categories studied have reached the peak of their development and their usage only in these last few years.

4.1. Limitations

The data used for this analysis wasn't complete, especially for the year 2023. The data extracted from the Crunchbase website was based on all the information published until July 2023, leaving two quarters of the year out of the analysis. Apart from that, it's easy to see from the research that not all founders publish the details about their

company as soon as they are available. Instead, it looks like they tend to wait some more time. If companies were to update their information more frequently, it would make this kind of analysis more accurate and complete.

Furthermore, on Crunchbase not all the important information about companies could be found, leaving some of the work up to the researchers by looking for the website and other information of the startups, which were unavailable in some unfortunate cases. An important aspect which is given for granted is that the information published by owners/founders of those startups are likely to respect the reality and they are not biased. It's assumed that, for example, fundings received by startups was published based on the actual amount collected and it was not rounded up or down for some other reasons. Basing the entirety of the analysis on this website could lead to false results if the primary information was to be false or incorrect.

Still on Crunchbase, when downloading the list of startups that have to do with innovative payments, tags and keywords are necessary to tighten the range of companies. Understanding which startups can be considered "in scope" and which "out of scope" was the part that took most of the time, as the researcher must have looked through all the information of the company and, if they were not present in the Crunchbase website, the companies' websites as well.

Another important limitation is brought up by China and other Asia countries. Not having any info on Chinese startups can completely alter the results of this study. China alone has more than 1.4 billion people and each single day 10000 startups are born (The Economic Times, 2015). Even if only 0.1% of them were focused on innovative payments, that would mean that each year in China there would be more than 3000 startups. This would completely change the results, in terms of categories, geographical distribution, target and fundings.

The last limitation, found during the writing of the literature review, was the missing information related to both startups and innovative payments. There are a lot of scientific documents related to both topics, but separately. There were only a few documents that were focused on startups based on innovative payments, but the information found was not useful for this kind of research, making them almost useless.

4.2. The potential of future research

In order to make the analysis more complete and the most accurate possible, it's suggested to wait one full year and make the research about the six previous years, leaving out the year that just passed, as most startups take some time to publish information about their fundings, for example. What has been presented on this thesis can be considered a full analysis based on the available data for the years 2019, 2020 and 2021. For the year 2022 and 2023 there could some missing information that would most likely be present on the website if the research was conducted a year later.

Another improvement to make the research more complete is to not base the entire data set only on Crunchbase, as it's been shown multiple times that there could be some misleading or even missing information. The solution is to use different sources of information, as it was done for the paragraph "Focus on Italy": form Crunchbase it resulted that there were only seven startups in italy, but with a few research on Google seven other startups came up. This goes to show that only because they are not on Crunchbase's dataset, it's doesn't mean they are not out there. Anyways, this small focus was possible for Italy since there were few startups, but such research would be hard to make for other countries such as UK, USA and China.

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