

MOBILE PAYMENTS AND EMERGING TECHNOLOGIES

Claudiu CHIRIAC^{1*}, Gheorghe HURDUZEU¹, Andreea-Alexandra CHIRIAC (ROȘCA)², Ioana-Coralia ZAVERA¹

¹The Bucharest University of Economic Studies, Faculty of International Business and Economics, Romania

²The Bucharest University of Economic Studies, Faculty of Marketing, Romania

chiriaccclaudiu14@stud.ase.ro

gheorghe.hurduzeu@rei.ase.ro

r.andreea90@yahoo.com

zaveraioanacoralia@yahoo.com

Abstract: *Considering the fact that in China, in 2016 solely, the mobile payment volume was around \$5 trillion – half of its gross domestic product, carried out through two main competitors – Alipay and Wechat Pay, it is becoming clearer that companies will invest piles of money in order to process the payments of the millions of potential users. With the banking industry shaken by the different modifications of rules and regulations and consumers addicted to the latest gadgets, the tech companies may have the pole position in this race. Apple is charging each Apple Pay user with 0.15% per transaction which may not seem a lot, but taking into account that in 2015 iPhone users traded over \$10.9 billion we can see why tech companies are eager to develop payment applications. In this paper are presented briefly the newest means of payment and how are those influenced or not by the emerging technologies. The most important piece in the puzzle – end-user – has to keep up with all the novelties in this sector and, as consequence, some behavioural patterns occur. With the appearance in the landscape of emerging technologies like 5G, augmented reality, virtual reality, blockchain etc. new waves are expected to redefine mobile payments. Those are presented further in the text altogether with some trends in financial services that may influence the mobile payments market as we know it.*

Keywords: *payments; augmented reality; virtual reality; 5G.*

JEL Classification: *E42; M31; O33.*

1. Tech companies and their initial undertakings

Since 2007, Apple showed that it's a real trendsetter with respect to innovative solutions and that it has something to say when it comes to mobile devices. Taking into account job creation, research and development investment, product selling and last but not least the annual reports, the company proved to be a key player in the world's economic environment. Looking at the numbers, each and every year, when Q4 comes and the launching of a new iProduct is scheduled, the device's shipments are hiking. With every new product launch and new technology implementation, the company is driving the portables industry in new directions and dimensions.

* Corresponding Author: Claudiu Chiriac

Starting with 2007, Apple Inc. led by its visionary Chief Executive Officer Steve Jobs, began to focus on developing portable devices. This was in his opinion an unexploited branch which he managed to improve it. Released in June, the original iPhone was 5 months away from the launching of one of the most coveted phone of that time – Nokia N95 8GB version. It had the specifications similar to Nokia N95 and with a \$599 price, it was even cheaper than the \$749 king of Symbian Operating System (Newsday Tribune, 2015). With thousands of mobile applications ready to be installed, Nokia had the first-mover advantage but it was misused. Having no data whatsoever about the users of their proprietary operating system and without any platform where the users could leave feedback (besides Nokia forum), Nokia developed applications just for the record and not for user's retention. Another downside is the inexistence of a centralized platform from where users could download verified and certified apps for their Symbian smartphones. One could download and install all kinds of apps that Nokia didn't know about, with the risk of installing malware. It was only at the beginning of 2009 when the Finnish manufacturer decided to operationalize its own store (Woyke, 2009). Launched in 2008, Apple's App Store was the first place where developers could promote and sell their applications to real users and those could install tailor-made apps. This was the first online store where users could download applications verified and curated by the manufacturer. It started with 500 apps but in May 2017 the total number of available apps reached 2.2 Bn. (The Daily Advertiser, 2013) (Costello, 2017). Eventually, this type of approach, with security in the first place, favoured today's in-app payment as we know it. With the launch of the iPhone 2G (first generation iPhone), Apple also introduced to the masses the capacitive touchscreen, a different shift from the existent one at that time – the resistive touchscreen. It was a major improvement because in order to operate the phone you were not required to use a stylus anymore. Another premiere was the use of the SIM card tray. Unlike the existing phones in order to insert the SIM card in the phone, you had to eject the SIM tray, put the SIM card on it and then insert it back. Both concepts are standard in the industry 10 years after the launch of the first iPhone. A trend-setting example worth mentioning is when Apple decided not to implement a fingerprint scanner under the display and ditched this technology in favour of facial recognition, introducing an infrared scanner in a notch at the top of the display. Right after this, the vast majority of manufacturers divided in those that aligned to this 'standard' and manufacturers who tried to get rid of the notch (e.g. Oppo).

Launched in 2010, with a mature technology onboard, the iPad followed a quite upward trend in sales and the company's cash growth increased from \$11Bn to \$39Bn (Bullish Cross, Philip Elmer-Dewitt). Innovative with some solutions, Apple is at the same time reserved when it comes to adopting hardware and software novelties. One example can be given by comparing the 2013 flagship phone of Samsung – Samsung S4 – released in April, with the 2017 flagship from Apple – iPhone X. It took 4 years and a half for Apple in order to implement wireless charging, compared to Samsung. It took also between 2 and 3 years compared to Google's Android Operating System to implement in their proprietary operating systems functions like notification center, personal hotspot etc.

2. Mobile payments – a short review

Phone manufacturers began to understand how important the payment system is for a mobile device and started to implement different types of sensors on different parts of the phone.

Some of them put a fingerprint reader just below the screen (Apple), other on the back of the phone (LG, Samsung, Huawei) or on the side (Sony) while newcomers like VIVO decided to implement it right under the display.

In 2013, with the launch of the iPhone 5S, Apple managed to shed the light first on mobile security and afterward on mobile payments. iPhone 5S was the first iPhone with an embedded fingerprint reader named Touch ID. Originally showcased as a method of stopping unauthorized use of the phone, this laid the foundation of the Apple Pay platform. In a manner that Alan Curtis Kay (1992) pointed out - 'People who are serious about software should make their own hardware', Apple started to develop a hardware solution. Launched in late 2014, iPhone 6 together with iPhone 6+ were the first mobile phones to embed both software and hardware solution for mobile payments. Both phones came with Apple Pay software preinstalled and had implemented the entire hardware set for a secure payment: NFC - Near Field Communication antenna, fingerprint sensor and a microprocessor that encrypts the transactions. NFC is a wireless technology requiring 4-10 cm to initialize a connection between two mobile devices; a standard that extends Radio Frequency Identification (RFID) by combining in one device the interface between a smart card and a reader (Dospinescu, 2012).

Referring to ecosystems it is worth mentioning that older devices like iPhone 5, iPhone 5S and even old generation iPod touch can also use Apple Pay to make payments but only with the NFC chip embedded in Apple Watch. Basically having an Apple Watch enables a non-NFC capable Apple device to make payments via Apple's dedicated platform. The sole requirement for Apple Pay is to have a device with minimum the 8th version of the Apple mobile operating system – iOS 8 – installed.

Unlike contactless cards, Apple Pay seals the payments covering a set of advantages. For example, when approving a payment, the software converts the card information into a hexadecimal code using the 'secure element' (Santus, 2014). This code can be read only by the point-of-sale. In case of a security breach, the card details are safe because hackers can see only a hexadecimal code and not the name and surname of the owner, card number, CVC code etc. The equivalent of this mechanism implemented in the physical cards is 3D Secure, considered to be a high standard of safety of transactions on the Internet (Dospinescu, 2012).

According to a study published by PYMNTS.com, conducted in collaboration with InfoScout – a consumer research company – when it comes to mobile wallet adoption, Apple Pay is by far the most used for payments. In 32 months since launch, the usage has risen threefold compared to 2014.

This is strongly related to the bank's adoption of mobile payment. If in the case of mobile adoption, the increase was almost linear, the number of participating banks expanded from 20 in 2014 to approximately 2500 in 2017 – 304 in Asia-Pacific, 112 in Europe and the Middle East and 2000 in the United States and Canada (Apple, 2017).

With the launch of anniversary iPhone, Apple introduced on their stage another biometric sensor – face recognition – alias Face ID. Facial recognition technology has sparked controversy since its launch when Craig Federighi's face was not recognized when he tried to unlock the iPhone (Richardson, 2017). The main declared purpose of this technology is to improve the unlocking time of the iPhone and to make mobile payments run faster. With the launch of the iPhone Xs, iPhone Xs Max and iPhone Xr in 2018, the Cupertino-based company showed that there won't be any comeback to Touch ID as we know it. There are some devices with Touch ID that are still selling in the Apple Store but starting with the 2017 flagship Face ID manages the default authentication on iPhones. There are although some voices that say that Apple actually skipped the embodiment of an ultrasonic fingerprint reader because it proved to be very expensive and time-consuming. However, it is well-known the fact that Apple tends to use in their products only mature technology so maybe this form of authentication will show up embedded in their screens with another name after it proves to be mature enough.

As we speak, both Touch ID and Face ID technologies are the pillars of Apple Pay Cash development. Implemented in the late version of iOS 11, Apple Pay Cash is a P2P – peer to peer service which enables users to wire money via iMessage – Apple's proprietary messaging application. All transactions will be authorized via Touch ID or Face ID.

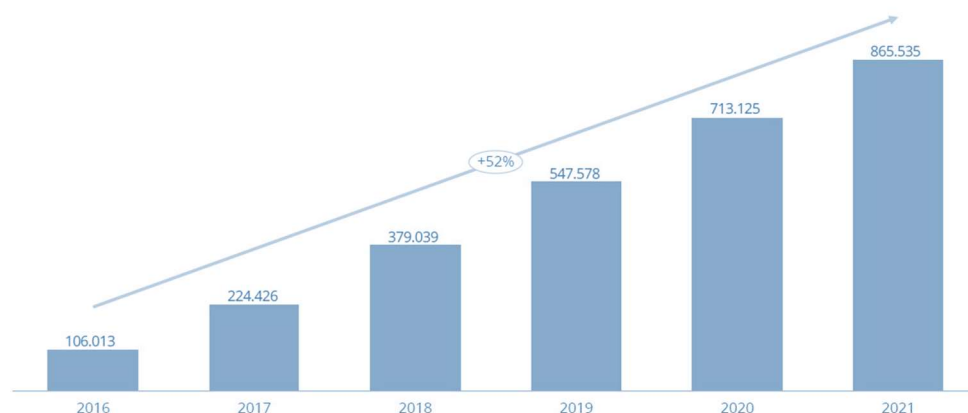


Figure 1: Global transaction value in the „Mobile Payment“ segment in million US\$
Source: Statista Digital Market Outlook, 2016, p. 4

One might think that the fingerprint recognition and face recognition are the latest trends in the field. Actually, they are not. The implementation of fingerprint technology dates back in 2004 (Germain, 2004) and the topics related to facial recognition were discussed since 1966 by Woody Bledsoe (1966).

Another possible fallacy is to assume that Apple was the first company that introduced NFC payments. When Apple Pay was launched Nokia had implemented NFC for 10 years but only for interoperability among different devices (Microsoft Devices Team, 2012).

The main merit of Apple is not the implementation of biometric sensors in their technologies, or the using an apparent obsolete NFC technology after 10 years of failure. The main merit is that they managed to raise, to mature the software and

then to integrate it with hardware, at the end developing a unique mobile payment ecosystem which inevitably induced competition among industry players (Zea et al., 2012). The main takeaway is that mobile phone manufacturers drive the growth of mobile payments at a rate constant rate of 52%, resulting a global transaction value of US\$866 billion in 2021, as presented in Figure 1 (Statista, 2017).

3. Emerging technologies and consumer behavior

The evolution of technology is also influencing consumer behavior and attitudes. The increasing number of the digitalized consumers is due to the fall of the price for technology; from 1999 to 2003, the computer price index has declined by 20% each year (U.S. Department of Labor, 2015) and is steadily decreasing, allowing the entrance on the market of new consumers. Between 2016 and 2021, the number of internet users will increase with 4 billion, reaching a whopping 6.1 billion high-speed data connections (Cisco, 2017). Moreover, 75% percent of the 8.5 billion people - the population estimation by 2030 - will have smartphone and internet access (Benson-Armer, et al., 2015). In the same time, the consumer's sophistication is also growing, the technology is perceived by consumers as beneficial, hence computers, smartphones, digital cameras, and the internet being considered factors that improve the quality of life (Hoyer & MacInnis, 2008, p. 364). This phenomenon of technology adoption is even more accelerated among younger generations who are highly connected. About 56% of millennials use two or more electronic devices daily in the United States, such as cell phones and the Internet (Hawkins & Mothersbaugh, 2016, p. 61).

The penetration of high-speed internet has brought significant changes to the online consumers and also changed the marketing and the research methods of the consumer. When it comes about the shopping, the consumers have a large gamut of options, because they can shop in the store, on the phone or on the internet. A study conducted in 2016 by Price Waterhouse Coopers shows that more than half of the online buyers are weekly or monthly online shoppers (2016). Not only that online shopping has sky-rocketed, but the consumer is currently shopping and choosing from a larger variety of products compared to the beginnings of the Internet. However, there are products with a higher associated risk for shopping via the internet, such as furniture, building materials etc. For this niche of products, the consumer uses the internet solely for information, preferring to shop in the traditional brick and mortar shop (Hoyer & MacInnis, 2008, p. 208).

In this new digital environment, consumers constantly move from one channel to another, from online to offline and vice versa. In this context, two new purchase scenarios are common in the digital area: showrooming and webrooming. The first scenario refers to customer journey which starts with visits to the traditional stores, but the product is bought online for a better price. The second scenario starts with learning about a product from online ads or social media. After the consumer decided which products are suitable for him, the purchase will be made in store (Kotler & Keller, 2016).

Taking into account the integration of multiple channels, the payment is the last step in creating this seamless customer journey adapted to a nowadays digitalized consumer. Because the consumer has many options, the mobile payments should distinguish from the others, emphasizing the benefits they have like speed, ergonomics, convenience and mainly security - one of the most important criterion.

The incentives altogether with other additional services can help the adoption of a certain type of mobile payment. For example, the developers may include an integrated system with discounts and loyalty programs for certain stores (Beutin & Dagmar, 2017).

New payment methods are emerging, as seen in Figure 2, mainly because nowadays digital commerce is no longer limited to smartphones, computers, and tablets. All the devices incorporated with sensors like home appliances, smart homes, smart locks, wearables and so on so forth have a great potential to bring changes in the current commerce but also in the payment system. Consumers are also switching from texting to voice commands, personal virtual assistants like Amazon's Alexa, Siri, Google Now and Cortana being more and more common when it comes to online shopping (Evans, 2017). It was even a mainstream joke when Jeff Bezos – the CEO of Amazon - bought the Whole Foods Market saying that he has bought it by mistake; he just wanted something from Whole Foods and ordered through his personal virtual assistant. Alexa misunderstood the command and has bought the entire company.

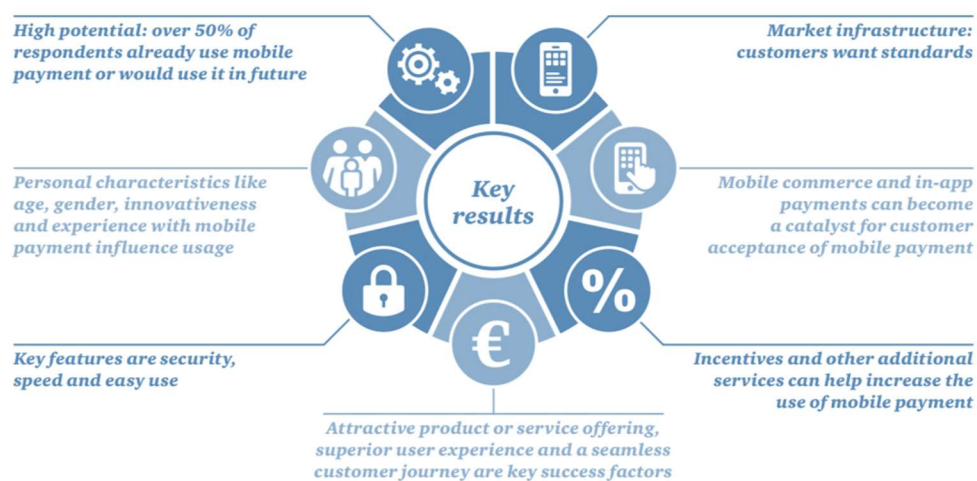


Figure 2: Mobile payment trends

Source: Nicolas & Dagmar, 2017, p.7

A recent study of Barclaycard Research shows that UK retailers lose approximately £18 bn./year just because their online shoppers add products to online baskets and then discard those items later (Barclaycard, 2018). A faster technology like 5G would reduce the loss as the increased connectivity speed will encourage the use of the emerging technologies like Augmented Reality (AR) and Virtual Reality (VR) by the retailers in better describing the products.

Even the traditional way of shopping will have some benefits from the implementation of the future 5G cellular connection speed. Now, when we go shopping there are only two ways of payment: cash or by debit/credit card, using a point-of-sale device. Imagine if you could scan the product and pay with your phone without having to stand in line. Such a technology like 5G has the potential to make store queues disappear. Shopping in a clothes store will reduce the waiting time because you enter the store, scan the products as you put them in the bag, and at the end, you pay

from your phone directly to retailer. The shop knows your location live, via the embedded position system. Practically the user's phone will be the next generation point-of-sale, which will replace 2G speed with 5G technology.

According to a PYMNTS.com study, 69% of respondents mentioned ease-of-use as the reason they were satisfied with how they authenticated an eCommerce transaction and 37% cited data security as the reason they were satisfied with how they authenticated (PYMNTS, 2018). This basically means that merchants must have in mind security and ergonomics when they design a payment platform. A multi-layered authentication could be a solution for online shopping. It is vastly known that if you are not that careful with your credit/debit card you could end up with your plastic piece being cloned or photographed and then posted on Darknet marketplace. From that moment there is only a fraction of time until you're left without money. A multi-layered authentication with the help of 5G technology could be the answer to this type of robbery (Carter, 2018). If all the ATMs would have a facial recognition system implemented on the site, complemented by a fingerprint scanner, it would be very hard to bypass it. Currently, what makes difficult the implementation of this technology is the low connectivity speed of the ATMs. With current cellular connection speed is impossible for an ATM to instantly capture and transmit to a predefined database the face of the user and to validate in the same time.

With 100 Gigabytes per second download speed, 5G network will be at least 100 times faster than 4G network (Kavanagh, 2018). This will offload in device data and will make physical space redundant as it sheds the light to cloud storage options. On the other hand, the cloud storage is sensitive and the security is weak, major file hosting service operators offering the possibility to log in only with a password. However, this stunning internet speed will definitely have a major impact on online shopping. If until now retailers struggled to upload on their marketplaces shy 360-degree photos of their products, once with 5G launching the AR and VR will enter in place. AR already started to gain audience when it comes to furniture stores. Ikea was among the first that released an AR app that helps users to virtually put products in their own nests. Basically, you can redesign your house from scratch. VR apps are still not that popular because in order to run they need expensive and powerful smartphones. However, the potential of this technology is huge as it can enable for example testing of certain products right from the bedroom at relieves users of unnecessary visits to stores, the test driving of a car

Micropayments could be a notion that will also rise from this emerging technologies. 5G could facilitate the payment for the exact amount of parking time and by connecting. The evidence could easily be done by electronic payment systems that will be implemented in smart vehicles. Also, in the transportation industry maybe will be implemented a system that will calculate the price ticket for a bus trip according to how many stations do you travel. There are a lot of potential uses for this emerging technologies but in the end, it depends on how much do we want to evolve on one hand and how much do we want to become vulnerable on the other hand.

4. Other trends in financial services

Technology influences the disruption on the financial services market. In this regard, there are some trends that will influence this industry, including mobile payments market, as it follows:

- a. Generally speaking, fintech companies and mostly start-up companies within this sector are innovating in a disruptive way by introducing new elements in the financial services chain.
- b. The sharing trends revealed in other industries, as automotive and accommodation may also be assimilated in this industry. The sharing economy will be enabled by information technology and will connect the capital providers with the capital users.
- c. Blockchain and technology embedded in cryptocurrency could be the future of mobile payments by delivering the security and ergonomics.
- d. Digital is no longer a novelty in the market, it becomes mainstream. The focus now is on big data analysis.
- e. The data about consumers' needs and wishes are no longer just based on what consumers declare, now the technology gives access to more in-depth information about what consumers want (e.g. analyzing the consumer's online conversations).
- f. The advances in technology and artificial intelligence will replace the interaction with a bank consultant with highly-skilled robots with the ability to learn and share information with other robots.
- g. The main infrastructure will be the public cloud as many financial companies use cloud-based software-as-a-service applications for business processes.
- h. The cyber-security is one of the main risks for financial companies.
- i. Asia will be the key center of technology-driven innovation.
- j. The regulators will use technology to better monitor and predict potential problems for creating adapted regulations (PWC, 2017).

5. Conclusions

If in the first part it was presented the manner in which the giant players from high-tech industry influenced and continues to influence mobile payments industry, in the second part the focus was on the consumer because it is a reciprocal bond. Not only the end-user has to keep up with technology but also the technology providers should be aware of the users' needs. In order to have implemented a successful mobile payment platform, high-tech companies and banks must work together in order to provide secure and ergonomic platforms. It is not enough to bring something new in the market taking into account that users tend to migrate to platforms that are simplifying processes. For this Apple is being highly criticized for the implementation of the controversial Face ID and dropping of the Touch ID payment method in the newest iPhones.

The main takeaway of this paper is that although the mobile payments industry is exponentially growing, is also very volatile, and it is directly influenced by the big tech companies and emerging technologies.

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Bio-note

Chiriac Claudiu is a Ph.D. student in the Bucharest University of Economic Studies – Economics and International Affairs Program. As Ph.D. student, Claudiu is focused on studying the mobile payment industry and what are the implications of this industry in the global financial environment.

Hurduzeu Gheorghe, Prof. Ph.D., is the dean of the Faculty of International Business and Economics within the Bucharest University of Economic Studies.

Chiriac (Roșca) Andreea-Alexandra is a Ph.D. student in the Bucharest University of Economic Studies – Marketing Program. As Ph.D. student, Andreea is focused on studying innovative methods and marketing research techniques applied to the modern consumer.

Zavera Ioana-Coralia is a Ph.D. student in the Bucharest University of Economic Studies – Economics and International Affairs Program. As Ph.D. student, Coralia is focused on optimizing welfare redistribution processes in EU member states.

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