



POSSIBILITIES FOR APPLICATION OF ELECTRONIC PAYMENT SYSTEMS IN RETAIL

Nenad Tomić,
Violeta Todorović

University of Kragujevac,
Faculty of Economics,
Kragujevac, Serbia

Abstract:

Electronic payment systems have come into focus of theoretical debates and business practices at the turn of the 21st century. They have arisen due to the migration of business processes in a new high-tech environment, as a result of the rapid development of information and communication technology. With an open global communication network, such as the Internet, e-commerce has become the dominant form of remote trade, creating an ideal field for practical application of electronic payment systems. Although the first association for electronic payment systems appliance is electronic commerce, these systems in different conditions may also apply in retail. The subject of the paper is the assessment of possibilities for electronic payment systems application in retail transactions. The paper aims to demonstrate the multifunctionality of electronic payment systems applications, and the variety of options they offer in modern trade.

Key words:

electronic payments, retail, digital wallets, paywave,
near field communication.

1. INTRODUCTION

Permanent development of information and communication technologies (ICT) in the second half of the twentieth century led to changes in the business model of a large number of manufacturing and service companies. Communication networks such as the Internet, initially used to create presentation of company's services and improve its relationships with customers, eventually became commercial channels. This means that a large number of products could be offered through the Internet, where the buyer and the seller can directly communicate in the process of trading. With the creation of software products, as a very important category within the overall ICT products, the Internet has also become a distribution channel, which solved the delivery problem to the end customer, which is one of the key problems for sale of physical products. This sets conditions for offering a wide range of services via the Internet, from translation and graphical design, to lecturing and programming.

In addition to the delivery of physical products, the method of payment has become the key problem of e-commerce as a new commercial paradigm of 21st century. Cash payments were physically impossible; payment through cash on delivery carried a big risk to the seller because the buyer could deny the transaction instead of receiving products.

Correspondence:

Nenad Tomić

e-mail:

ntomic@kg.ac.rs



Transfer order was slow; its execution was interrupting commercial flow, and was expensive. Credit cards payments were unattractive to consumers due to the fear of data misuse. Electronic payment systems (EPS) incurred as payment systems in electronic commerce, and are particularly specialized in transactions via the Internet, in which the buyer and the seller have no physical contact.

Shortly, different categories of EPS have been created, specialized for particular types of transactions, or trade of certain products. Although primarily intended for online use, EPS can also be applied in retail even when the buyer and the seller are physically present (Rigopoulos, Psarras, Askounis 2005). Although retail is dominated by cash and credit cards payments, an increasing number of ERS has recently become compatible with the existing payment infrastructure. The meaning of EPS application in these circumstances is in the added value that their application provides to users.

The subject of the paper is the assessment of possibilities for EPS application in retail, when the buyer and the seller are physically present. The paper aims to demonstrate the multifunctionality of EPS application, and diversity of opportunities they offer in the modern trade, as well as to highlight the added value that their application provides to users. The notions of EPS will be discussed in the first part of the paper, along with typology of these systems based on the payment channels. In the second part, the technological foundations of EPS will be presented, including the analysis of contribution of each technological feature for the functioning of the system. In the third part, the case studies of the EPS applications in retail will be carried out, with the examples of two mobile digital wallets and two applications that are used not only for making payments, but also for ordering a product/service.

2. THE CONCEPT OF ELECTRONIC PAYMENT SYSTEMS

Electronic payments represent the exchange of monetary value, with partial or complete use of electronic media. In practice, this means that at least one of the elements of the payment process migrated to electronic basis, and that is not executed in paper form (ECB, 2004). Cash payments are the only non-electronic payments today, while for all forms of non-cash payments, ICT is used to a lesser or greater extent, in the initiation of payment, transfer of payment instructions or in the process of settlement, so that in the domain of non-cash payments one can discuss semi-electronic payments,

or fully electronic payments (ECB, 2007). An example of semi-electronic payment is paying bills for different types of services that are executed in the bank or at the post office, and initiated in paper form (physical transfer of paper bills to the payment provider), but further transfer of payment instructions and settlement are performed electronically through a computer system that is connected to the payment provider's computer.

A fully electronic payment should be initiated through electronic channels with the use of adequate payment instrument. The electronic payment channels include the access point where the first contact of instrument and the system takes place, and where the initiation of payment transaction begins (Vuksanović, 2009). The most widespread contact channel is the point-of-sale (POS), which can be found at the cash registers in supermarkets, shopping centers and gas stations. Increasingly widespread contactless electronic payment channels are the Internet and mobile phones, which allow users to access the payment process without physical contact with the seller. As a payment instrument, payment cards are most commonly used in both cases.

The use of plastic cards at POS terminals is a classic form of card payments, which requires the presence of the card, physical contact between buyer and seller and is authenticated by the PIN number. This payment method has practically not been changed for decades, and for this reason will not be the subject of analysis in this paper. On the other hand, in the payment process where the Internet is a channel of initiation, the seller is not provided with an insight into the buyer instrument. These transactions are referred in the literature as the card-not-present transaction (CNP). Due to the absence of physical contact, CNP raise a number of safety issues, from the issues of security and privacy of customer data, to the question of authentication of both parties in the transaction. It is this type of transactions that has given space for creation of a large number of EPS, which not only solve the security and authentication problems for both parties in the payment process, but also offer added value through customer support services. Thus, some systems do not allow the buyer to take over the money until the goods are delivered, while others allow automatic application of discounts or loyalty programs in the process of payment. The EPS that can be applied in both e-commerce and traditional retail will be the subject of analysis.

With high applicative power of smart phones, a large number of applications previously available only on desktop computers have been developed, including



digital wallets. It is the EPS application that securely stores information, passwords and PIN numbers to be used in a variety of payment methods, and can contain address for delivery of purchased goods, membership cards and consumer information about loyalty programs or collected points for discounts or sweepstakes. Although these applications can be used for CNP transactions (hence the address for delivery of purchased goods), the main purpose of the digital wallet applications is in retail.

3. TECHNOLOGICAL BACKGROUND

Modern achievements in ICT domain, both hardware and software ones, form technological basis of EPS, along with payment cards, which create the monetary basis for the system functioning.

Payment cards are the main payment instruments in almost all EPS. The payment instrument is defined as a medium that carries monetary value in a transaction. Most EPS use the existing payment cards accounts as the basis for sending or receiving funds. The owner's personal data, account number and security figures are hidden, and are not exposed on the Internet or other communication network used for payment execution. During the exchange of payment instructions, user accounts communicate without sending sensitive personal data.

Mobile phones entered commercial use in the mid-nineties of 20th century. The basic functions of these phones were calls and text messages, although the producers soon began to expand the range of services by equipping phones with cameras and software bringing entertainment content. With the advent of smart mobile phones, the operating systems have become almost as powerful as those on computers. This has enabled the development of a large number of applications, of both entertaining and business nature. In addition to the previously mentioned applications of digital wallets, mobile phones have become a kind of payment emulators, because in one place, in one application, customers are now able to keep data on different methods of payment, addresses for delivery of purchased goods, the membership and consumer cards, information on loyalty programs or collected points for discounts or sweepstakes. Opportunities offered by the smart phones applications made them suitable for payments in retail, so some authors emphasize mobile payments as the "next big thing" in the field of payment services (Smith, 2014).

Internet is the next important factor in the EPS use. With its commercial application in the early nineties of

the 20th century, the Internet has revolutionized business models of various traditional activities. Electronic trade takes on a whole new dimension, since it was the first time interaction of the participants was possible through open networks, where administrative borders posed no obstacle. The payment method remained the only serious obstacle for further development of e-commerce. Combined with computer technology, the Internet not only allows remote access to the consumer online store, but also a way of making payments with the use of EPS. Leaving aside the very important issues of security and privacy of such transactions, the Internet and computer technology have contributed to the creation of opportunities for consumers to purchase smooth without leaving home. Wireless Internet access (Wi-Fi) offers additional value Internet users, since they can access resources without the need for a wired connection of their devices and access point. Wireless signal provides particular benefit to users of portable devices - laptop and tablet computers, and mobile phones, which can maintain permanent Internet connection even in motion, with less frequent use for desktop computers.

Bluetooth is a wireless communication network, which is used to exchange data between two static or mobile devices at closer range. It was originally designed to make easier and faster connection establishment between mobile phones and desktop computers, but later became a standard for data exchange between portable devices. One device can communicate with up to seven other devices, provided that the quality of communication links decreases with the number of paired devices. Unlike NFC technology, which serves a similar purpose, Bluetooth works on wider distances (up to 15 meters between devices) and allows higher data transfer speeds at optimum connections. The flaw is slower pairing, which requires the approval of both sides to establish a connection. Although its great application in the field of electronic payments was originally expected, NFC technology has taken its place in this domain.

Near Field Communication (NFC) technology is a wireless short-range communication technology used to transfer data between two devices equipped with appropriate sensors. Vasković (2012) points out that for communication of two NFC devices it is necessary to have at least one active device (equipped with NFC signal reader, which can also broadcast and receive signal) and one passive device (can receive NFC signal, but cannot broadcast it), or both devices can be active. For a successful data transfer, to the two devices must be at a distance of 10 centimeters or less. Mobile devices can



easily be set at this distance, paired, separated again after use. The first advantage of NFC technology is automated pairing devices without requiring user name recognition for connecting and receiving data. Another advantage is safety - unlike Bluetooth connectivity, NFC connection is due to the short-range harder, but not impossible to eavesdrop on, and perform data theft (Weiss, 2011). This technology has quickly found application in payments in retail with the support of the largest card institutions. Visa developed payWave terminals for contactless payment cards based on NFC data exchange technology, while MasterCard did a similar thing with PayPass terminals (Pasquet, Reynard, Rosemberg, 2008).

4. APPLICATION OF ELECTRONIC PAYMENT SYSTEMS IN RETAIL

An increasing volume of funds is effected without the use of cash. The household sector has predominantly used cash payments for a long time, but during the last few decades, the share of non-cash payments have grown even in this sector, primarily in developed countries, and then in developing countries as well. Nowadays, for example, in the Scandinavian countries, cash payments account for only 5 % of total payments.

Mobile digital wallets

Below is a case study of two most popular digital wallet applications, their performances, achieved results and their potentials.

Google Wallet (GW) is the first functional digital wallet, created by today's largest Internet company Google (since the end of 2015 known as Alphabet). The idea behind GW was to take advantage of the growing potential of smart phones with integrated NFC readers, and the increasing diffusion of contactless POS terminals based on payWave and PayPass solutions. GW as an application could be installed exclusively on new Android mobile phones, equipped with an NFC reader (but at the time of occurrence, there was only one model, Google Nexus S, which supported application). The user would connect application to his current account or credit card account to add a certain amount of money on application balance. Within the limits of the available balance, the user would be able to pay at contactless POS terminals.

At the very beginning GW faced many organizational problems. First of all, apart from a small number of mobile devices that could support it, GW was the exclusive feature of mobile provider Sprint (Chae,

Hedman 2013). This means that although a user would possess a supported mobile phone model, he would not be able to use the application if his number is maintained by another carrier. Google decided to make it Sprint exclusively, as the other three major carriers in the US - AT&T, Verizon and T-Mobile US - were working at the same time on developing their own digital wallet called ISIS (today Softcard). In addition, the problem was the low compatibility with financial institutions. In the beginning, customers were able to use only Citibank's MasterCard cards for adding funds to their balances, while payments could be made only on PayPass terminals (on payWave later, when Visa joined project). This resulted in a much lower applicability in practice than expected. Ozcan and Santos (2014) explain this problem with difficulty of forming a consortium of companies from different sectors. Companies that are among the most dominant in their sector hardly accept any other role but a dominant one when called to enter a new market.

In late 2015, Google has separated the GW functions into two new applications - Android Pay, which took over the functions of the old GW, and from now on will be used for retail payments, and the new GW, which will be used only for P2P sending money between two users. The main difference is that Android Pay becomes the exclusive Android application, whereby Google wants to compete with Apple.

Apple developed its own digital wallet application for mobile payments known as Apple Pay (AP) in 2014. This application works only on iOS devices, version 8 and later, and can be used for payments in retail, thanks to NFC antenna, which latest generation Apple devices are equipped with, and also for online shopping. Two features that distinguish AP compared to similar applications are high acceptance of applications, both by vendors, as well as by financial institutions, and steps taken to ensure a high level of security through two-factor authentication system.

AP can be used on iPhone 6 and later models, as well as combined with AppleWatch smart watches for payments at retail, while on tablets iPad Air 2 and iPad Mini 3 and later models can be used for online payments. Common to all devices above mentioned is the existence of Touch ID function, a fingerprint sensor used as a form of authentication in transactions. Devices that are used for payments in retail are equipped with NFC antenna, which in addition to communication with contactless POS terminals provides an additional form of authentication.



The setup process starts with entering data on payment instruments (debit and credit cards). The first and simplest way is to download data from user's iTunes account, if there is already active payment instrument. Regardless of whether there is a payment instrument or not, the new payment instruments can be added later, by entering the required information, or taking a photo of a card through the app. After entering the card information, it needs to be authenticated by the issuing bank (in March 2016, 1,069 banks in the US, and a few dozen of banks in other countries have joined the program, Apple Support, 2016). All instruments will be visible in the main application menu, where one of the cards is chosen as the default payment instrument, which can be changed afterwards. The application uses customer data for delivery address in case of purchase through the Internet.

The advantage that the Apple stresses when paying in retail is privacy. Personal information on payment instruments is not uploaded to user's iCloud account. The data is visible in the application itself, but is not shared with the seller. Instead of real card numbers, and PIN/CCV number, AP uses the principle of tokenization (MacRumors, 2014). When a user enters their payment instruments, the data is stored in the so-called secure element, while in a transaction a unique Device Account Number is used instead of real card number. This number is not even known to the Apple, and it replaces cards numbers in all transactions executed via given device. To confirm the transaction, the device creates one time dynamic security code that serves as an additional form of authentication (MacRumors, 2016.) NFC antenna, used to establish the connection to POS terminals, does these authentication activities. Anyone who succeeds to intercept communications between Apple device and terminals, or to read the contents of a terminal database, will find tokens for single use only, which are unusable after the transaction, and cannot be used for deriving real account number.

All mentioned forms of authentication executed in a period less than a second, helped by the Touch ID. Fingerprint is provided in the initial device setup, and is used to help unlocking the device. The transaction process can be performed even if the device is locked. The user brings the device near contactless POS terminal, which wakes the device using NFC communication, and automatically activates AP. By placing a finger on the Touch ID sensor, the user confirms ownership, allowing the transaction to be performed. A short beep and a mild vibration indicate that the transaction is executed, and if the device was previously unlocked, the payment

is confirmed visually by checking the bill in the application. If the user wants to change the default instrument before payment (say, to switch an insufficient funds debit card to credit card), he double clicks on the home button (which is on all devices at the same time a fingerprint reader) to *get all* accepted payment instruments among which he can choose a new default instrument.

Since October 2015, the AP accepts store payment cards, which can be added into the application, and set as automatic choice, so that one store card is used as the default payment instrument in the objects that belong to the specific store. Another advantage of using AP in retail is in collecting points in the promotional activities of a particular retailer or product lines, which can be used in further payments.

In assessment of the mobile digital wallets prospects, their limited applicability is often cited. As Rosenblum (2013) explains, users would remain indifferent whether they use payment card or mobile phone as long as they have to stop and take something out of purse to make payment. In this sense, AP does not make difference – the user has almost the same movement mechanics as when paying with contactless payment card, with difference that AP pose no limit for the amount of the transaction (limit exists in the UK, not in other countries). However, the essential advantage is in a higher degree of security and privacy that AP offers. The real card numbers are never shared with the vendor, so there is no fear of theft or misuse. Apple is committed not to follow the user transactions, not in location nor in content, so the only party that knows your purchase, as before, is the bank. Also, the Find my iPhone function can block the use of AP in case you lose your phone, so even if the thief succeeds to break the password for unlocking the phone, he would not be able to use the application for payment nor to read confidential data.

AP can be used at over 2 million locations in the US, and in the UK and China it is supported by a few dozen of banks. In Canada and Australia, the AP can be used only with American Express cards. In the coming period, Apple targets closed systems, such as airlines (in-flight shopping) and university centers for spreading its application usage.

Applications that integrate ordering and payment

There is a growing popularity of applications that combine the possibility of electronic ordering products/services with electronic payment upon receipt or payment in advance. In the following chapter, the world



phenomenon for ordering transportation Uber is introduced, along with successful domestic service for online food ordering known as Donesi.com.

Uber is a mobile application for ordering transportation, where everything except driving is done electronically - ordering transportation, driver selection, monitoring the arrival of the selected driver on the map, estimation of price, payment, driver rating. In March 2016, the application was usable on all continents in over 390 cities. It implies total absence of cash, and relies on electronic payments, where the payment cards are used as a basis.

The user downloads and installs the app on his smart phone, where all relevant mobile operating systems are supported. Transport ordering is done simply by opening the application and selecting ordering in the menu. Prior to ordering, it is necessary to choose address that ride starts from. It can be entered manually, by typing the address, from which user wants transfer, or with the help of GPS and Wi-Fi locating, when the user is found on his the current location (Uber Help). To order transport, user is required to select a payment instrument (if more than one instrument is available). Also, it is necessary to enter the destination address so the driver who takes the ride knows in advance how long the drive will be, and at what price. Once the system accepts the order, the nearest available driver is contacted and sent to the address. The user can see the driver in advance and also can follow his movement with estimated time of arrival, but the driver cannot be changed. The user can also obtain the driver's phone number for direct contact in case the starting location changes. The application supports cancellation option, which is charged for cancellation fee.

Once the passenger enters the taxi, a price of a ride can be estimated based on the destination address and expected time of ride. Final price may vary depending on traffic density, but also on whether the trip goes through the sections where access must be paid (highways, tunnels with taxes, airport parking). The total amount is paid via the selected payment instrument. The user can file a complaint if he deems that the total cost of trip is not calculated appropriately. Finally, after completing the ride, the user rates the driver. Uber aims to retain only those drivers that are evaluated positively, which in turn requires the responsibility of the user. If the drivers are constantly given bad reviews, Uber will terminate the contract with them, so next time there will be fewer available drivers in the offer, and it will take much time for a ride. If there is no complaint, the user receives a

certain number of credits that would be deducted from the total cost of the next ride. In the user wants to pay trip with his own money and to collect credits, he can disable the use of the credit in application.

As a payment instrument, the user can input some of his payment cards, pre-paid card, or a digital wallet account. Using a pre-paid card is not recommended, because a large number of issuers are not support in the application, although itself it is possible. Apple Pay is available on iOS devices, same as Google Wallet on Android phones. Also, Uber account can be linked to a user's PayPal account in a number of countries.

Donesi.com is domestic application for online food ordering from restaurants. In addition to the major cities of Serbia, the app is functioning in several cities in Montenegro and Bosnia and Herzegovina. The basic idea of this service is the online food ordering, with the precise amounts of meals, portion sizes and spices, where one electronically sent order arrives within seconds to the desired restaurant. The service first started to work as a classic web site, and today there are applications for different mobile phones operating systems. When registering, users leave information about their address, based on which service filters only those restaurants that deliver to the given address. If the user is currently located in a different location, he can change a neighborhood or even the city and look at the offer. In addition to the search based on restaurants, Donesi.com offers search by meal (for example, one can search pancakes only or burgers only in all restaurants in the offer).

Basically, this service does not require mandatory electronic payment (Donesi.com FAQ). Given that it only works as a mediator of order, and that it charges percentage of total price from the restaurants it cooperates with, Donesi.com is indifferent to payments in cash or electronic payments. For a large number of restaurants card payments are supported, as well as QVoucher payments. It is an electronic voucher purchased from the issuer - Lanus company (see option where to buy online qvoucher.rs). The idea is that online transactions can end up in an efficient way via the Internet without the use of payment cards. This is very important for those targeted groups that do not have the conditions for possession of a payment card - say student (Vuksanović, Tomić, 2014)

Since the beginning of 2015 Donesi.com is owned by Foodpanda, the German service for online food ordering. It can be expected that the future activities would be focused on more intensive computerization of operations, and possibly introduction of new payment methods.



The essential difference between Uber and Donesi.com, is in the particular role of service. Uber does not own vehicles, but signs contracts with free cab drivers, who agree that Uber charges for their services, and receive salary on previously set conditions. Uber undertakes distribution of rides to the closest drivers, charges passengers and takes into account the quality of service. Donesi.com also owns no restaurants and does not prepare meals, but accepts the orders and forwards them to the desired restaurants. However, Donesi.com does not accept payment, does not process the transactions and does not affect the final price of the restaurants' services. It has a contract to charge a fixed percentage of total prices but cannot affect the price or the quality of service. If the customer is not satisfied with services provided, Uber will react by changing the driver, while Donesi.com cannot change anything in the restaurant. Hence their current differences in payment automation.

5. CONCLUSION

Electronic payment systems have completely different roles in e-commerce and traditional retail. While they are practically a necessary condition for proper functioning of e-commerce activities, in terms of the traditional retail electronic payments are still viewed as a touch of exoticism. With the exception of the classic payment card usage at POS terminals, all other methods of electronic payments in retail still do not have the sufficient scope that would point them out. The figures that show the trend of growth of various mobile payments applications in the last two to three years are indeed impressive, but it must be taken into account that they are resulting from low basis, practically close to zero.

Among mobile digital wallets, AP shows greater potential than others. This time Apple gave up the innovator role, leaving other consortia to offer their own versions of the digital wallets, and learning from their mistakes. Apple behaved less dominant than Google, and therefore had a better starting point in negotiations with banks and credit card organizations, and retailers. The high brand loyalty of Apple users has been materialized, and thus Apple Pay has quickly gained huge popularity. The problem of this service may be the same as its biggest advantage – no matter how loyal users of Apple products are, insisting on iOS exclusivity prevents application from winning a larger market share. Apple elitism may rapidly slow the growth of AP use in the years to come in the same way it sharply accelerated its acceptance in 2014 and 2015.

As for applications that combine the possibility of electronic ordering products/services with electronic payment, there are still a lot of possibilities. From enclosed can be seen that innovators come from developed economies, where the culture of consumption is such that customers quickly adopt new services when it tends to save time by automation of all processes that are subject to standardization. Essentially, transportation and food ordering are the services that customers need daily, and ways of ordering can be easily standardized. One of the services that is possible, and what is realistic to expect in the future is electronic shopping in supermarkets, where user could purchase certain products in advance based on the electronic catalog, which would later be delivered to his home. It is a service that is also needed to a large number of users on a daily basis, but in a similar form, it would be possible to provide a huge mass of similar services.

The evidences of business processes migration to the electronic base in the second decade of the 21st century are obvious. The real problem that may slow down these processes in the coming period is the division of responsibilities and benefits, as it is obvious that the business conditions and the relative importance of specific companies have changed. To fully evaluate the role of electronic payments, and in particular their penetration in the traditional retail sector at least 5-10 years will be needed.

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