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## **COMPARATIVE ANALYSIS OF APPLICATIONS OF SELECTED MOBILE PAYMENT SYSTEMS IN POLAND**

**Abstract:** The basic aim of this article is to evaluate mobile payments used in Poland with regard to their usefulness as compared with card payments and bank transfers. First, research principles and procedure have been formulated. Next, the author conducted analyses and presented detailed characteristics of the obtained findings. In the last part of this paper the author presented a summary, conclusions as well as further directions for development of m-payments in Poland, which have been formulated in the study.

### **1. Introduction**

In recent years the greatest emphasis in electronic banking development is being placed on two tendencies: creating a vocal interaction for systems and offering full dynamics of access to websites and electronic payment systems. Additionally, on the basis of Gartner Group's report, we can conclude that payments made by means of mobile phones increasingly gain popularity among users. The report further suggests that the number of people using mobile payments in the world is to increase by 70.4% in relation to last year's figure and will amount to 73.4 million. According to a definition provided by Gartner's analysts, the term "mobile payment" refers to making a payment for a product or service using one of the following technologies: SMS, WAP, USSD or NFC [<http://www.computerworld.pl/news/345767/Lubimy.m.platnosci.html> D. Niedzielewski May 2009]. It is also assumed that a mobile payment (m-payment) consists in performing payment transactions by means of mobile devices [Borcuch 2007] such as mobile phones, palmtops, smart phones, etc. Transactions of mobile payments can be conducted in traditional points of sales such as, for instance, shops, shopping centres, petrol stations, vending machines as well as in mobile and virtual points of sale via the Internet.

The basic aim of this paper is to identify features of particular payment systems with a view to applying them in electronic commerce and using them by an individual client in Poland. This paper is a continuation of the author's previous papers

concerning electronic banking systems, in particular, the research performed in 2004<sup>1</sup>. The present study analyses five most popular mobile payment systems, verifying them in terms of their products and services range, the ease of application, additional functionalities they offer as well as general users' opinions. The examined systems were electronic payments using SMS Premium technology offered by mobile networks operators, MasterCard PayPass payment system, Visa payWave, mPay (Płać Komórką [Pay with Mobile]) and PayPal. They were also compared with payments of:

- traditional payment cards [Chmielarz 2005] – firstlings of all mobile instruments, taking into consideration a possibility of tapping and viewing, stealing a card or the data it contains,
- electronic transfers – internal transactions of Internet bank, for which majority of virtual banks do not collect any charge, where the time of carrying out the transaction is virtually equal to zero, and which are more and more frequently available also with a mobile path due to the Internet access of mobile devices.

A research method applied in this study is a comparative analysis with the use of the criteria described below:

- availability (the number of places and points of sale),
- attractiveness (variety of services and products which can be purchased using m-payments),
- the ease of making transactions by users of particular systems,
- the speed of making transactions,
- system's functionality (the number and quality of rendered services, system's advantages and disadvantages),
- evaluation of a number of transactions and amounts involved in them,
- security of transaction (authorization, fraud risk),
- additional services offered within each system,
- costs: fees and charges paid by the system's users,
- psychological factors: users' confidence in using the system (credibility and image of companies, institutions and brands, habit of using services of a particular company, tradition, etc.).

Each feature has been subjectively evaluated according to the following assumed and applied evaluation scale: 1.00 – very good (complete criteria fulfilment, the most user-friendly system, the most attractive offer and the lowest costs); 0.75 – good (almost complete criteria fulfilment); 0.50 – medium (partial criteria fulfilment with medium costs); 0.25 – sufficient (satisfactory criteria fulfilment and high costs). Each feature has received a score, and subsequently, its value has been relatively compared with the same feature in another system.

The research procedure has been realized in the following way. First, criteria and research assumptions have been applied. Next, the author has characterized and ana-

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<sup>1</sup> Cf. [Chmielarz 2004, pp. 210-218], research concerned comparison of naive payments, bank transfers, PayPal, PayU, AllPay, Nochex system, payment cards and micropayments.

lyzed the most popular mobile payment systems in the Polish market. After gathering data, each expert has evaluated the previously specified features of each system according to the adopted scale. Subsequently, on the basis of the most frequently recurring evaluation results for each feature (dominants), the author constructed a single, combined scoring table. The analysis of evaluation results of particular systems and drawing conclusions have completed the research procedure. Five experts from Warsaw academic circles who use electronic payment methods participated in the study. In the combined table the author has presented results of comparison of assumed criteria for selected methods of mobile payments (Table 1). In the first stage payments were evaluated with a simple scoring method and equivalent treatment of each criterion. Findings have been processed in two ways: according to a preference scale proposed by research participants and by means of the author's own conversion method<sup>2</sup> taking into consideration relations among criteria (similarly to AHP method).

## **2. Comparison of selected mobile payment systems and conclusions**

Combined scores of comparison of particular systems are presented in Table 1.

After adding up scores of the comparative analysis it turned out that bank transfers have still obtained the highest score in experts' evaluation (83% fulfilment of the maximum possible values), and the subsequent position has been taken by the system of mobile payments using SMS Premium services offered by mobile network operators (80%)<sup>3</sup>. It is caused by the costs of using this method, which are relatively low in comparison with other forms of on-line payments [Chmielarz 1999]. Using bank transfers guarantees a user that the money will reach the selected beneficiary, and in the case of bankruptcy, bank will return all financial resources being in the user's account. Banks apply additional security measures in case an unauthorized person succeeds in accessing a user's account; the time needed for the money to reach creditor's account is very short (with an interbank transfer the time of crediting another person's account does not exceed an hour, and in the case of an internal bank transfer, it is equal to a few minutes). Informing a creditor about the payment made into his or her bank account is connected with the time of crediting the beneficiary's account. The creditor is immediately notified about the payment, which significantly accelerates his or her reactions. It also depends on the connection with a bank clearing system. An additional advantage of an electronic transfer is flexibility of making payments. Owing to guarantees and additional security measures, electronic banks are one of the more secure methods of making payments via the Internet. However, despite additional security, breaking into a user's virtual account means

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<sup>2</sup> Described in detail in: [Chmielarz 2009].

<sup>3</sup> Cf. [Balla 2009], the thesis did not consider the category of payments by standard transfers.

Table 1. Comparison of selected mobile payment systems

Evaluation criterion	Preferences in %	SMS Premium	mPay	PayPass	payWave	PayPal	Traditional payment cards	Bank transfers	Total	% of the maximum score
Availability	15	1.00	0.75	0.50	0.25	0.75	1.00	0.75	5.00	71
Attractiveness – products and services range	10	0.50	0.75	0.50	0.25	0.25	0.50	0.75	3.50	50
Ease of making transactions	15	1.00	0.50	0.50	0.50	0.25	1.00	0.75	4.50	64
Speed of making transactions	5	1.00	0.25	0.75	0.75	0.50	0.50	0.50	4.25	61
General functionality	15	1.00	0.75	0.75	0.75	0.50	0.25	1.00	5.00	71
Evaluation of transaction limits	5	0.25	0.50	0.50	0.50	0.50	0.75	1.00	4.00	57
Transaction security	5	0.50	1.00	0.75	0.75	0.50	0.25	0.75	4.50	64
Additional services	5	1.00	1.00	0.50	0.50	0.25	0.75	1.00	5.00	71
Costs: fees and charges	20	0.75	0.50	0.75	0.50	0.50	0.50	0.75	4.25	61
Psychological factors	5	1.00	0.75	1.00	1.00	0.50	0.50	1.00	5.75	82
Total	100	8.00	6.75	6.50	5.75	4.50	6.00	8.25		
% of the maximum score		80	68	65	58	45	60	83		

Source: own calculations.

gaining access to his or her financial means. The reason for it is that virtual banks do not offer the service of an intermediary account which could function similarly to a virtual card. When a user is not using such an account, the balance of the account is equal to zero; a moment before making a transfer, money is moved directly to the account which is being currently used. Virtual banks, whose operations are based on other kinds of security, do not offer users any possibility of confirming correctness of the order which has been placed: in the case when a user does not spot the error, he or she will not have a chance to withdraw the submitted request.

The service which takes the second place among tested solutions, SMS Premium, is characterized by the greatest availability, as it can be used by every owner of any mobile phone with an active SIM card. Also, it is worth mentioning at this point that an almost simultaneous debut of mobile payments on Polish market together with voting live via SMS messages during the first series of Big Brother reality show were helpful impulses for an increase in popularity of this kind of services. Another factor which contributed to the fast development of the market was a common decision of the three biggest mobile network operators in the market to coordinate their ranges of telephone numbers and charges for SMS Premium in their

price lists. The agreement concerning uniform number ranges and fees for SMSs with premium charge has been achieved relatively easily owing to the fact that for a long time each of the three mobile network operators (Polska Telefonía Cyfrowa, together with its brand – Era; Polska Telefonía Komórkowa Centertel with its brand – Idea; Polkomtel with Plus) has had a similar market share. Uniform numbers and charges facilitated marketing communication of the services and reduced its costs, and made new SMS Premium-based services available in all mobile networks from the moment of their emergence. Three mobile network operators adopting coherent policy concerning SMS Premium based m-payments market have been in a relation of one to many, as compared with other players in the market, like integrators, content providers and, also important to this segment, a media market represented by television stations, broadcasting stations, the press and Internet portals. It enabled them to decide on business conditions and share in income from services amounting to 50-55%. A majority of income from SMS Premium is generated by entertainment services (competitions, lotteries, voting, chats, SMS dates) and services connected with personalization of mobile phones (ringtones, wallpapers, screen savers, etc.). Popularity of short text messages and the ease of sending them contributed to the relatively large number of points obtained in the study.

The third place was taken by mPay, which works virtually on every model of a mobile phone. A user does not have to change a mobile telephone, install additional software or buy another SIM card. Vendors do not have to own payment terminals as this device can be replaced with a mobile phone, to which a transaction confirmation is sent. In the situation where a particular point of sale already has a cash register or a payment terminal, these devices can be integrated with mPay system, the system which has received the highest scores with regard to products and services range. The advantage over competitors in this case results from the fact that mPay clients who decide to become owners of electronic purse, can, in contrast to SMS Premium users, use the purse to pay for snacks and drinks in vending machines, services of gastronomic outlets such as McDonald's, Telepizza, Pizza Dominium, or coffee chain Coffeeheaven. Also, it is possible for them to pay for a transportation fare in some taxis of the Warsaw corporation Taxi Plus, make payments in Internet shops or pay electricity bills. Płać Komórką (Pay with Mobile) is the only system, among those examined in the study, which enables a functionality of paying on behalf of another person, for example if we refuel at a petrol station and, unfortunately, it turns out that there is no money in our account, then we may call another user of an mPay account and ask him or her to proceed with the transaction. In turn, the highest score for the ease of making a transaction belongs to SMS Premium. Undoubtedly, sending messages with specified content to a number of a particular systems does not cause any difficulty even for less advanced users. In this category payments based on text messages with premium charge turn out to be slightly better than systems of payment organizations. In this particular ranking PayPal system has received the lowest score due to the fact that in order to make a payment, you need access to electronic mail.

If we consider the speed of making payments, the situation appears to be similar. Sending an SMS message and a subsequent receipt of return message confirming using a given website seems to be the quickest. You need slightly more time to make a contactless payment. The penultimate place in this category is taken by PayPal, and mPay due to its extended scenario of payments received the smallest number of points. In general categories of systems' functionality the highest score was given to SMS Premium. mPay, PayPass and payWave payments have received the same scores. The last position was taken by PayPal which offers the smallest range of possibilities and functionalities.

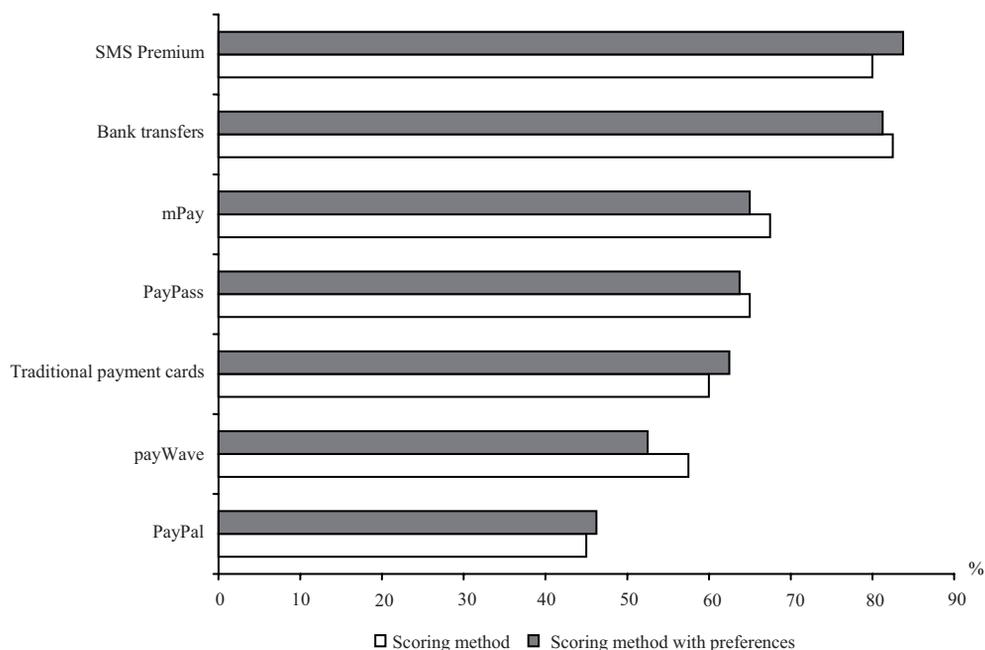


Figure 1. Ranking of analyzed m-payment systems

Source: own calculations.

The greatest weakness of SMS Premium payments are limits imposed on transactions. It is caused by adopted price lists for sending messages and the lack of system's flexibility resulting from the latter. There are no limits of the maximum number of messages that may be sent by an individual user; however, this fact is not as important as a possibility to make payments without limits imposed on the amounts involved.

An extended scenario of making payments in mPay system contributes to its best score with regard to security. A return message containing details of a given transaction and an additional need to confirm the transaction with a PIN code eliminate the

possibility of an error or a payment made by an unauthorized person, for example in the case of a mobile phone being stolen or lost. The second position in this category is taken by contactless payments and PayPal. In PayPass and payWave systems there is a possibility of making a payment of less than PLN 50 by unauthorized users, while transactions involving larger amounts of money demand an additional authorization using a PIN code or signing a confirmation of the transaction. In the case of PayPal, the system's security is determined by the way in which the user defines access to his or her mail box, i.e., if a client uses a function of remembering passwords or consciously avoids using it, precisely, in order to increase the level of security and protection of his or her email account. Simultaneous using of one's email account in the payment system is an idea from the previous century.

In the category of additional services we may distinguish two systems: mPay and SMS messages with a premium charge. It is probably caused by the fact that telephone terminals are at present equipped with additional functionalities such as, for instance, mass memory, multimedia players, etc., operators also offer a whole range of additional services. The offers of banks and payment organizations are markedly weaker. In this category PayPal system takes the last position in the ranking.

With regard to fees and charges all systems obtained similar scores. As we all know, clients have to pay for using all products and services in the form of charges depending on the number of completed transactions or the amounts involved in them or, as in the case of SMS Premium, costs are included in the price of each message which is sent. On the basis of the evaluations of obtained scores, we may conclude that none of the systems may be distinguished both in terms of advantages or disadvantages for clients.

Psychological criteria were the last evaluated factor. Well-known global brands MasterCard and Visa contributed to the best scores obtained by contactless payments. However, the same refers to traditional payment cards. Also, SMS Premium system offered by established brands of mobile network operators, both local (Plus, Era, Play) and global ones (Orange), has received the maximum score. A subsequent position was taken by mPay, which, as a relatively new brand, still needs to work on its position on the market and customers' trust. Credibility and image of PayPal system have received the lowest score. Low costs of using the service are the strengths of the system; however, these advantages do not compensate for all its weaknesses. On the other hand, PayPal is one of the most popular systems with the greatest number of users. How may we account for the described paradox? It seems that it does not result entirely from a specific "obligation" to use the system in making Bay payments; it appears that the habit of using the system is also important for clients. Interestingly, in the research conducted in 2004, this system has also taken the last position. The lowest scores result from a low security level of the account, a long time which is needed for clearance of the creditor's account, a strong connection with bank clearing system and low guarantees used by the website. A low level of security of a user's account is the result of the fact that you need to register a

credit card on the website, which later creates a possibility for unauthorized people to use it. The system's operations consist in collecting financial means from PayPal account. It is a user's intermediary account, and the danger is that in the case of lack of sufficient financial means in PayPal account, the requested amount will be automatically charged against the registered card. The time of money transfer from the PayPal debtor's account to PayPal creditor's account is short, as in any payment website. However, if we wish to withdraw money to our bank account, this process takes from 5 to 7 working days. Among PayPal's strengths we may list: low costs of using the website, a large degree of flexibility and an immediate notification of the recipient about crediting his or her account. However, these advantages do not compensate for all weaknesses of the website.

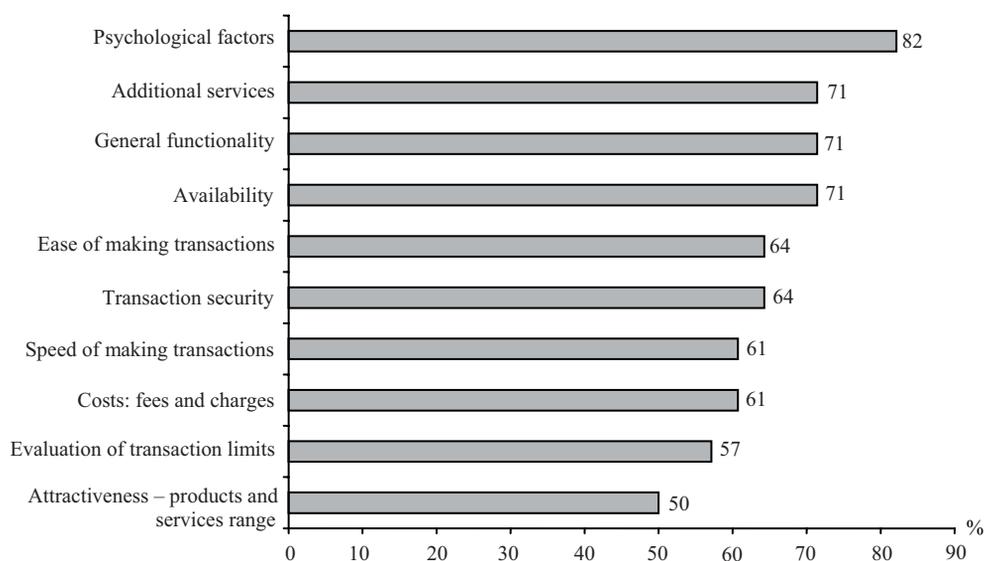


Figure 2. The degree of fulfilment of particular criteria by m-payment systems

Source: own calculations.

Traditional card payments take an interesting position in this comparison. In the case of this method, connection with the banking system is of great importance. It allows the user to be certain that in the case of a card number being stolen or a money transfer being “lost”, costs incurred by the user as a result of abuse or neglect shall be returned to the client. Procedures of such kind may take a long time due to the time needed for crediting the beneficiary's account and charging the debtor's account. A majority of Internet payments by means of a payment card needs little time to authorize a payment, the result of which is the fact that the creditor learns quickly of crediting his or her account. Also, a debtor quickly receives a confirmation of

a payment release. Usually, payment cards are one of the means used with money orders in a selected payment service. Costs related to this method are one of the lowest among the examined payments. Unfortunately, even though this method of making payments has many advantages, there are still many disadvantages. One serious drawback is a relatively low level of security. The number of a card and other related data can easily fall into the wrong hands, which may lead to serious abuse. Also, the lack of an intermediary account means a very low security level. If you have your card stolen, the thief has full access to your bank account.

According to experts' evaluations, psychological factors were characterized by the greatest degree of criterion fulfilment. The academics believed that the presented systems are well advanced and they deserve the high score also with regard to consumers' trust (company's reliability, etc.). Availability, functionality and access to additional services have received similarly high scores. The lowest score was given for attractiveness – products and services range. The divergence between the largest and the smallest degree of fulfilment of a given feature is considerable, and it amounts to over 30 percentage points.

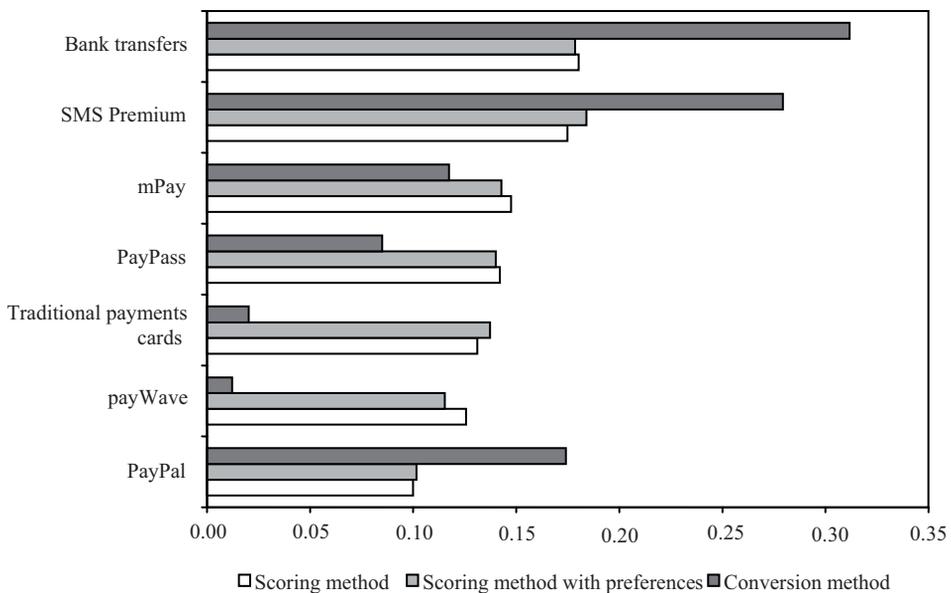


Figure 3. Ranking of examined m-payment systems according to a scoring method, a scoring method with preferences and a conversion method

Source: own calculations.

An experiment with changing preferences, even in such an extreme case as the one which is analyzed – where 20% have been assigned to economic criteria (costs), has not produced significant results. It has changed relations between the fulfilments

of particular functions in relation to all analyzed items; however, on the whole, it has not changed the order of the ranking. Diversification of experts' evaluations concerning particular mobile payment methods and a large scattering of evaluations resulted in flattening and a large degree of similarity of results in the analyzed case.

Simultaneously, the author used an opportunity to conduct a study into possibilities of applying the author's own conversion method to m-payment websites' evaluation. The fact that the author based the study on distances from the mean values of evaluations and relations among particular criteria caused significantly greater differences in scores than in the previous experiment. The first position was still taken by bank transfers and SMS Premium system. However, PayPal system is already in the third position due to its range of activity, scope and popularity. The lowest scores in the ranking belong to payWave systems and, surprisingly, completely dissimilar, traditional payment cards.

### 3. Summary and conclusions

On the ground of the analysis of mobile payments in Poland, we may conclude that the development of Polish m-payment market has occurred relatively late in comparison with other markets: for a few years the only method of payment by means of a mobile phone were solutions such as SMS Premium. The situation changed after 2001 when domestic mobile network operators started to offer services based on text messages with a premium charge, and later the operators took a dominating position on the market.

At present, the most popular mobile payment systems are SMS Premium services offered by mobile network operators. Due to lack of flexibility and the fact that without operators' obtaining a bank license or a license of electronic money institutions there are no real possibilities for the system to develop, it cannot be treated as a developmental direction.

The situation of mPay system appears to be different. This system, which first has been offered by an agent or selected mobile networks, and later engaged a representative of a banking sector, is a Polish forerunner of m-payments that draws on global experiences. The development of this system suggests that mPay and operators of the most important mobile networks will become its prospective co-owners with regard to Płać Komórką (Pay with Mobile) service. The present co-owner, Citi Handlowy bank, is to step aside and all banks will be able to join the project by virtue of obtained licenses. Also, it appears that there are additional obstacles to a banking sector's involvement such as a simultaneous development of card payments and an alternative, possible development of smart cards-based contactless payments.

In this situation, speculations on the development of mobile payment market may take the following directions:

- dominating share of independent mobile payment providers such as e.g. mPay; eliminating banks' share from the market by obtaining banking licenses and establishing cooperation with telecoms and payment organizations;

- dominating position of banks, aiming at eliminating mobile network operators from the mobile payments market and attempting to gain independent control over the whole value chain; systems of contactless payments like PayPass and payWave may serve as an evidence for the case;
- agreement between all market players is possible; the same refers to offering a range of common services.

The direction for mobile payments' development in Poland depends on many factors. One of them is persuading market participants that applying m-payments is better and more convenient than cash transactions, especially for small value transactions. Mobile payments may become competition for credit or debit cards, because they may replace the latter in the case of low-value payments. The degree of clients' and market participants' assimilation of this kind of payment may be another factor. M-payments require creating conditions where they will be treated by clients as user-friendly, fast and safe. Also, from the point of view of vendors, mobile payments should create a possibility to realize transactions more cheaply than with payment cards. The third factor is a necessity to solve technological problems and an attempt to work out a common standard for mobile services. Considering the expected standards, it is worth noting that factors such as user-friendliness, transaction security and clients' trust seem to be of prior importance to a user at a technical, organizational and legal level. One more important question concerns economic factors (charges on transactions, relations of fees to other payments) which are an incentive to use the services.

One should also note that there are also certain threats for the development of these forms of payment. Among the most significant possible obstacles we might list clients' habits of paying in cash and a large number of entities participating in transactions. Most of them have ambitions to dominate the market. Moreover, lack of technological standardization does not support the development of this area, which makes a larger number of implementations more difficult.

According to Gartner, in the nearest future mobile payment market will dominate mainly Asia-Pacific region and Japan, where the cutting-edge technologies catch on more quickly than elsewhere. Gartner's specialists estimate that the number of people using m-payments in the region will rise from 2% in 2009 to around 4% in 2012 [<http://www.computerworld.pl/news/345767/Lubimy.m.platnosci.html> D. Niedzielewski, June 2009].

Benefits which the development of mobile payments may bring are increased sales of products and services as well as improved customer satisfaction achieved through automation and accelerating transactions. However, this development may require incurring additional costs associated with educating users, purchasing new technologies, implementing new systems and adapting existing ones to the needs of m-payments.

It appears that the situation of Poland follows a pattern which we could see earlier in other countries which started to offer mobile payments. Mobile network

operators were the first to introduce the services to the market, and subsequently, the banking sector started to be involved in the processes. At present, we observe a specific “guerilla warfare” where the two forces attempt to gain a dominating position in the market.

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