
TRENDS IN DIGITAL PAYMENTS – SERBIA'S DIGITAL PAYMENTS INDEX

Ilija Etinski, Bogdan Stanišić, Aleksandar Aleksić, Ivan
Radanović

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Payment System Department

NATIONAL BANK OF SERBIA

Belgrade, Kralja Petra 12

Telephone: (+381 11) 3027 100

Belgrade, Nemanjina 17

Telephone: (+381 11) 333 8000

www.nbs.rs

Trends in digital payments – Serbia's Digital Payments Index

Ilija Etinski, Bogdan Stanišić, Aleksandar Aleksić, Ivan Radanović

Abstract: Technological advances over the past decades were conducive to the payments industry and exerted a significant impact on its trends. Today, payment service providers offer a wide range of payment instruments, applications and services and all these elements often rely on information technologies. Owing to the development of these solutions by the payments industry and their acceptance by users, the processes of payment service digitalisation and digitisation unfold. To track these processes as much as possible, this paper proposes a method for the analysis of payment transactions in Serbia, which captures all the elements relevant for the digital payments industry in our country. The result of the proposed analysis method is Serbia's Digital Payments Index (DPI), which gives a new dimension to monitoring the evolution of payment transactions, specifically in the digital segment. The DPI is an index that shows the evolution of the use of digital payments in Serbia over time. It is based on five pillars. Digital payments trends in Serbia are in sync with global trends and the most state-of-the-art payment methods are on offer. When it comes to the use of cards and e- and m- banking channels, the number of users and transactions are on the rise, making a significant and steady upward pressure on the DPI in recent years, which means that the spread of digital payments in Serbia increases year after year.

Keywords: payments, digitalisation, development, payment services, NBS, cards, mobile phones, DPI, COVID-19, statistical reporting, Serbia

[JEL Code]: C43, C80, E42, E58

Non-technical summary

Money transfer methods are improving every year owing to the technological progress applied in the creation of payment services. For this reason, digital payment methods are gaining in prominence. They entail the use of mobile smart devices, computers, cards and other media which enable the transfer of funds without a physical exchange of cash at brick-and-mortar and online points-of-sale, as well as in other transactions of natural and legal persons. Efforts to improve and globally expand the digital payments market were stepped up in the last two decades of the 20th century. Beside technological progress, the widespread use of digital payments is additionally supported by i) the changes in the supply of payment services which are becoming increasingly competitive and are no longer in the hands of financial institutions only, but also non-financial payment service providers, ii) regulations conducive to the development of safe payment methods and increased market efficiency, and iii) acceptance by end-users which depends on setting competitive price structures in the payments market, use value for consumers, but also external events, such as the COVID-19 pandemic, which shape users' perception and preferences.

Trends in Serbia indicate a greater use of digital payment methods, the most dominant being m- and e- banking and payment cards, where innovations are the most frequent and are duly recognized by users as such. The main contributors are a regulatory environment conducive to the introduction of new payment services and digitisation of existing ones, the establishment of modern payments systems (NBS IPS payment system), and connecting the existing payment methods to smart devices in the market, i.e. using available technology to cover additional market niches. The effects of the COVID-19 pandemic inevitably encouraged Serbian citizens to pay even more attention to contactless, digital payment methods.

Serbia's Digital Payments Index (DPI) was created by adjusting the Reserve Bank of India's DPI to the conditions in our market. The purpose is to show the spread of digital payments in Serbia over time. The Index covers only digital payment methods, without cash and paper-based instruments (paper transfer orders, payment slips, cheques, etc.), in the following categories: payment services infrastructure; degree of technological development; payment performances and customer experience. These categories are separate areas in the payment ecosystem, starting from the infrastructure which entails the issuance and acquiring of digital payment instruments, through the degree of technological development which analyses the conditions enabling the use of digital payments in the territory of Serbia, payment performances which measure the extent of use, i.e. digitisation of payments, all the way to customer experience that relates to the data about the awareness and experience of consumers with the use of digital instruments. The methodology for making the DPI is based on the calculation of the value of each individual pillar for every year, using the indicators of that pillar, after which these values are weighted by the relative importance carried by each pillar in the Index, and then added up. Using the indicator whose result is a unique value, a steady increase in the value of the Index was established in the observed period, which means that the condition of digital payments in Serbia is improving year after year. The Index measured 180 last year (2021) and this value is interpreted as an improvement of the condition of digital payments by 80% compared to the base year (2016). The increase serves as positive feedback about the development of the digital payments ecosystem in Serbia.

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1 Introduction

Payments and payment services industry is an exceptionally wide area having gone through significant changes in the past several decades, which resulted in increased efficiency, security and use of services. Amid such developments, smart devices are increasingly used for digital payments and the payments industry is becoming more and more popular with financial service providers.

To attain their market goals, financial service providers, more specifically payment service providers and technological companies greatly exert a positive influence on the deepening and penetration of digital payments. Payment systems executing those payments record the same trend and today the quantity of information they process is much larger than in the previous decade, which enables more efficient cash flow management and monitoring. A payment system is a part of the financial infrastructure of a country which enables the transfer of monetary assets between participants in the system. It comprises a set of instruments, procedures and systems for the transfer of monetary assets that enable money circulation. The system should be reliable, which primarily implies safe transactions and the continuity of availability for users.

In meeting these and other requirements, without losing sight of the still indisputable importance of cash, a modern payment system relies on the rising importance of digital payment services, i.e. digital payments. In the broadest sense, digital payments may be considered transactions which do not use cash or other analogue payment instruments (cheques, paper transfer orders, payment slips, etc.). In this paper, the concept of digital payment primarily refers to the transfer of funds from the payer's to the payee's account based on the exchange of information in the digital form from the payer to the payee through their payment service providers who do the transfer.

Digital payments are constantly evolving, reflecting ongoing interaction between payment service providers, information technologies and the needs of end-users. As a result of such developments, and partly due to the need for better speed and safety, innovations replacing the use of cash may be traced back to the second half of the 19th century up until the latest trends such as digital currencies.

As digital payments are undergoing intense development, the need for measuring their trends, results and ultimate impact on the economic system rises. Many institutions, companies and independent researchers are trying to keep track of developments in this area and this paper is only one in a series of attempts to contribute to a better understanding of the ways of monitoring the digitalisation of payment services and measuring the achieved results. The digitalisation of payment services on its own does not automatically and necessarily bring better conditions for economic development or for collective positive impact. Keeping track of the evolution of digital payment services enables the establishment and analysis of their direction and potential for contributing to economic growth. Accordingly, this paper constructs the DPI which observes the most important five categories in the digital payments ecosystem, trying to define the value that represents their cumulative development in the territory of Serbia. The Index helps define and monitor the data relevant for further productive

development of digital payment services and is an instrument which can help identify the drivers and the stoppers of payments digitisation in our country.

The paper is divided in six sections. The next section will give a historical overview of the development of payments technology and its evolution starting from traditional fiat money - cash, more precisely, from the first recorded payment which did not involve physical transfer of money in a direct interaction between the payer and the payee, up to modern tendencies including digital payments. What follows are analyses of the global landscape of modern payment types and the trends in Serbia. After that, the Serbian DPI is presented, as a new method for the analysis of the use of digital payments in Serbia over time.

2 A brief history of digital payments

An important breakthrough in using technology for payments was recorded in the second half of the 19th century. In 1871, American company Western Union made a “remote payment” using the telegraph. First a payer would pay the money to the nearest telegraph station and then the station would send a telegram to another station where the payee would take the funds. Different passwords were used as a security mechanism for payment authorisation and the estimate is that in the years that followed the value of such transfers exceeded two million dollars a year. After the initial breakthrough, cashless payments progressed at a moderate but constant pace technologically, at an already established main principle – what was in fact transferred from one point to another was the message to debit the payer’s account and credit the payee’s account.

At the very beginning of the 20th century the described payment method, though somewhat modernised, was used by the Fed for the transfer of funds, while in the following several decades the technological development of cashless payments was associated mainly with payment cards, also in the western hemisphere.

The next chapter of the evolution of cashless payment instruments was dominantly written by Farrington Manufacturing and Diners Club between the 1930s and 1950s. The former was a pioneer in producing metal payment cards largely like the ones used today – of rectangular shape and bearing the payer’s personal data. The latter launched the first card in the market. Unlike previous cards, this one was in general use, used with more merchants. It was Diners Club innovation in particular that provided the necessary momentum to intensifying market competition and thus, to new technologies and business innovations of other participants in the national and international market. The 1970s were marked by the penetration of two innovations in the issuance and acceptance of cashless payments (dominantly card payments back then): the magnetic stripe card with information about the name of the holder, account number and date of expiry (as a non-patented IBM invention) and the ATM. In the same decade the ATM was upgraded by PIN verification by the user. By 1984 the number of ATM terminals across the world is assessed at around one hundred thousand. In 1979, Visa invented a payment terminal, i.e. POS terminal, without which card payments are unthinkable. It was widely used already during the eighties. Later in the decade, specifically in 1986, a French card brand Carte Bancaire launched the first chip & pin payment card in the market, which required an identification number as a security mechanism at a point-of-sale.

The 1990s saw new IT breakthroughs, as a result of intersecting the internet and payments. In this way, soon after the initiation of mass commercialisation of the internet via applications, i.e. browsers like Navigator, somewhat later Internet Explorer, or the founding of companies such as Amazon and Yahoo!, e-commerce also became a mass phenomenon. Following the first online transaction at a book shop website in 1992 and the first consumer system for online payments introduced by Stanford Federal Credit Union in 1994, online payments became widely recognised by the market with the establishment of Paypal, an institution specialised in online payments, which was acquired later by another great e-commerce market player, eBay. Though Paypal was established in 1998 as one of the cornerstones of modern e-commerce, the first traces of what is today called m-commerce already emerged at the time as an attempt at transferring payment functions from computers to mobile phones which today are the key instruments in modern cashless payments.

Last, it is important to approach the phenomenon of increased use of cashless payments from the market demand side i.e. without overlooking consumers' tendency to respond to incentives, particularly price incentives. Namely, consumers react to incentives, but the reaction is neither unambiguous nor easily definable. For instance, a research exploring the dynamics of cashless payments in the Netherlands and Norway in the period between 1990 and 2004, demonstrated an intuitive correlation between an increase in debit card payments (positive correlation from the point of view of cashless payments), a rise in money withdrawals from ATMs (indicator of cash use) and the average price of using these instruments. Namely, in the said period, the average hike in the prices of using/accepting debit cards was 2% and ATMs 14% on an annual level. At the same time, the average annual increase in debit card transactions in Norway and the Netherlands stood at 25% and 33%, respectively. The dynamics are clear when previously matched with the annual rise in ATM money withdrawals: 3% and 9%, respectively. One should bear in mind that on the supply side, in addition to banks, merchants and other technological companies, even the governments themselves have an interest in increasing cashless payments. Knowing that e-transactions are considerably cheaper than those executed by means of physical instruments and that costs of payment transactions may amount to 1–2% of GDP, it is clear why the digitalisation of payments, i.e. their gradual transition from dominantly paper-based to dominantly digital form is welcomed and promoted by various policies.

3 Digital payments today

Digital payments have gained traction in the last couple of years. The activity of market players in digital innovations in this area would have continued at least linearly. However, the main incentive to the globally stepped-up trend of innovations unequivocally came from the COVID-19 pandemic. Despite the initial destructive impact on the real economy of a great number of countries, the pandemic provided a strong market incentive to many banks, card and fintech companies, encouraging them to innovate, speed up and simplify cashless payments. In addition to the immanent profit motive, the need for new innovations was also induced by the rising market demand for cashless payment modes, i.e. consumers' fear of using cash. Accordingly, considering technological innovations in digital payments in recent

years, it is important to have in mind the catalyst and not the causal significance of the pandemic. In other words, innovations in digital payments would have occurred anyway, but not with such intensity and to such extent.

The above is no surprise bearing in mind that in recent years payments, as a global market segment, proved to be one of the most dynamic and promising banking/financial services. This is easily discernible in a comparative overview of standard banking activities from the point of view of overall value creation, approximated with a total shareholder return (TSR) of selected publicly listed companies. Such an overview for the 2009–2020 period can be found below.

Chart 1 Comparative overview of added value creation by different banking/financial activities



Source: Denecker, Lishinsky et al. "A burning platform: Revamping bank operating models for payments", The 2020 McKinsey Global Payments Report, October 2020. Adapted by the author.

In addition, Chart 1 shows a unique business vitality of the payments industry. Owing to the dynamic upward trends in recent years, if not decades, and despite the direct negative impact of different government measures implemented as a protection from the contagious virus – primarily lockdowns – the largest payments companies have rebounded surprisingly quickly. When governments lifted radical prevention and protection measures, the usual business processes resumed in these companies and continued developing almost as normal.

According to available information, the total value of payments by credit transfers initiated digitally recorded a robust growth in both advanced and developing economies (BIS, 2021). More specifically, an increase in the number of e- and m- banking transactions, as well as standing orders transactions, induced a notable rise in the value as a share in GDP of countries across the globe. There is another perspective to qualitative changes in payments, an insight obtained through polls surveying consumer habits of the population. According to the McKinsey's Digital Payments Consumer Survey conducted in 2020, more than three quarters of Americans use some form of digital payment instruments. In terms of dynamics, it is important to note that in 2016, 34% of respondents making digital payments used a single instrument i.e. a form of digital, cashless payments. However, in 2020 the share dropped to 20%, while 58% of consumers using digital forms of payments stated that they used two or

more different instruments. In terms of the pandemic, an even more significant insight was that in 2019, 36% of respondents stated that they were interested in contactless payment card (27 pp), or were already using it, while at end-2020, 53% stated the same (interested in using – 32 pp, using– 21 pp).

Considering the obvious advantages of cashless payments for payment service providers and consumers, and their dynamics and impact on the global economy, one can succumb to the impression that the use of cash is declining. Nevertheless, it is still rightly perceived as a rather safe payment method. Also, according to the data of Simon Kucher marketing agency which explored the American consumer experience, cash is perceived as the fastest payment method, followed by payment cards which are swiped or inserted in a POS terminal. In fact, mobile phones, regarded as the key instrument in technological innovations in payments, are deemed a considerably slower method (Ke, Chung et al, 2019). The said study concluded that the reason was the time distance (e.g. ten seconds) between the initiation of a mobile payment and electronic authorisation, i.e. receipt of confirmation of its final realisation – perceived as too long. During this interval, the focus of consumer's attention is on the waiting and the waiting time is overestimated, while cash payment does not suffer from such a problem, bearing in mind the payment procedure is fraught with action (taking out the cash and handing it over, taking over of cash by the salesperson, handing over the merchandise and the receipt, etc.), which reduces the consumer's feeling of wasted time, i.e. time lag. On top of that, almost a half of the reasons stated against the use of mobile phones are concerns over identity theft and fraud. This goes hand in hand with the information that barely 7.6% of respondents consider their mobile phones the preferred payment method.

The above means that cash and payment cards are frequently used payment instruments. The fact that at this point as much as 7.6% of the population prefer using their mobile phones for payments indicates that mobile payments have a large development potential. Promoting this method by offering different combinations of rewards and incentives, more simplified applications and hence consumer experience, as well as by creating a stimulating environment where mobile phones are desirable payment devices, may increase the presence of phones in the payment services market in the future. At the same time, this is the guidance for future bank and company operations in applying finance, i.e. information-communication technologies in payments.

4 Digital payment trends in Serbia

The digital payment trends in Serbia are in line with the global trends in the supply of modern methods of executing payments, whether at a brick-and-mortar (physical) or online point-of-sale. The use of digital payments has recorded a continuous rise in recent years, in terms of both the number of executed transactions and new users. Factors affecting their rise depend, among other things, on the payment instruments that market participants offer to users, while at the same time ensuring services that are secure and high-quality. Innovations implemented in the framework of payment instruments further affect the development of services and their acceptance by end-users. These innovations concern improvement of available smart devices in the market, such as the capacity of mobile phones to use QR codes

or the ability to connect payment cards to smart devices (mobile phones, smart watches and similar devices), but also innovations related to the improvement of the speed of processing and sending payments, and therefore faster transfer of money between accounts. Moreover, it is the users' preferences that ultimately determine the choice of the instrument from a range of instruments offered in the market. Last but not least, events such as the COVID-19 pandemic gave rise to new influences on users' preferences, such as reducing health risks, and hence giving importance to online stores and contactless payment methods.

In recent years, the most common channels for initiating digital payments used by consumers and corporates were m-banking, payment cards and e-banking. In 2021, the annual number of m-banking transactions increased by 8.5 times (up by 47 million), payment cards by 2.4 times (up by 205 million), and e-banking by 1.6 times (up by 58 million) compared to 2016. Hence, in this group, the highest growth rate is recorded by m-banking, which reflects the positive influence of innovations, as well as the fact that mobile phones are used every day. On the other hand, although they do not have the fastest growth dynamics (due to the large base of transactions), payment cards carry the status of the most used instrument in the payment market, primarily due to their simple use and the range of physical and online points-of-sale with implemented solutions for their acceptance. Also, payment cards in their digital or tokenised form (NFC technology in mobile phones or smart watches) expand the possible ways to initiate card payments and thus cover a larger segment of the payment market. Greater use of cards is evidenced by the expansion of the network of POS terminals with the function of accepting card payments at physical points-of-sale by over 30,000 from 2016 to 2021. This is how the market of payment services develops on the side of both acquiring and issuance of this instrument.

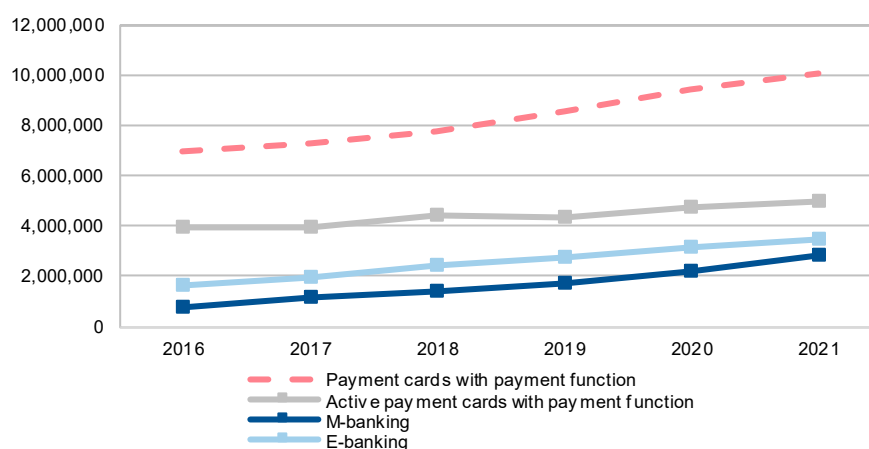
Owing to innovations that contribute to the efficiency of payment execution, above all to the speed of execution, additional benefits are created for end-users, primarily in terms of availability of funds in the recipients' accounts within a few seconds. This type of innovation was implemented through the Instant Payment System of the National Bank of Serbia – the NBS IPS, a system for processing retail payments (individual payments whose amount does not exceed RSD 300,000) in the territory of the Republic of Serbia. The system operates 24/7/365, that is, in real time. Since its launch on 22 October 2018, the average time required to process a transaction sent to the system is 1.1 seconds, which makes the services connected to this system the fastest channels for transferring funds from the payer to the payee's account.

Beside the basic possibility of making an instant (credit) transfer to any payee with a bank current account, additional services enabled in the NBS IPS payment system refer to the payment of monthly bills for public utilities and other services by scanning the unique NBS IPS QR code on the bill/invoice; using the IPS Scan and IPS Show methods at physical and internet points-of-sale; using Transfer service – with a specific payee's code, i.e. his mobile phone number. There are also the Generator and Validator services that enable the generation (technical preparation) of the NBS IPS QR code, as well as the validation (technical check) of an already prepared NBS IPS QR code. The acceptance of this innovation is evidenced by the number of transactions processed in the NBS IPS payment system, which has been growing year after year, with the average daily number of transactions in 2019 reaching 19,066 payments, while in 2021 that number was six times higher – 115,787 payments. Also, market

players offer applications that use the NBS IPS QR code concept, that is, they create and offer a service which allows their users to simply request the transfer of funds to their account from the payer by showing the payer the NBS IPS QR code with their current account for scanning. Therefore, the established payment system and its products do not only affect the execution of payments, but encourage innovation in the economy, with greater inclusion and opportunities for the providers of technical and/or payment services within the Serbian payments industry.

The growth in digital transactions correlates with the number of new users who are increasingly opting for digital payment channels. Firstly, generally speaking, the basic prerequisite for their increase is the percentage of the number of people who have been using the internet daily in the past three months relative to the population of Serbia – 57% in 2021 vs. 44% in 2016. This data is particularly important for payment methods that require an internet connection, starting with online purchases with payment cards, which increased by more than 23 times in the same period (from 870 thousand to 20.5 million). When it comes to the number of users of digital instruments, in the period from 2016 to 2021, the number of m-banking users increased by 3.8 times (to 2.8 million) and e-banking users by 2.2 times (to 3.5 million). The total number of issued payment cards with payment function increased by 1.5 times (to 10.1 million) and the number of active payment cards by 1.25 times (to 5 million). The mentioned indicators are shown in the following chart:

Chart 2 Number of registered m- and e-banking users, issued and active payment cards with payment function



Source: NBS.

The COVID-19 pandemic has undeniably led to the accelerated adoption of digital and contactless payment methods since 2020, significantly determining consumer preferences. The results of a study conducted between 7 April and 4 May 2020 in the Republic of Serbia showed that 24% of respondents who made online purchases after the pandemic did not have this habit before the pandemic (Ivanović & Antonijević, 2020). The authors also state that the three main motives for online shopping are as follows: most stores are online only, reduction in health risk, and saving time. For those who did not purchase online before the outbreak, but started doing so afterwards, the first two motives for shopping online are the same, while the third one is different – lower costs. In addition, it was determined that the majority of respondents purchased the following product categories online: food (groceries), medicine and books (magazines, newspapers). Respondents who did not shop online before the outbreak of the

pandemic, but started afterwards, mostly bought clothes and sports equipment and household necessities, followed by food and books, magazines, and newspapers.

Considering the above, the process of digitalisation of payments in Serbia directed towards m-banking applications is in full swing. M-banking is currently the fastest growing payment instrument. As a global trend, mobile phones stand out as the drivers of development and innovation in the field of changes in payments, with mobile phone payments gaining in popularity after the outbreak of the pandemic. The increasing use of m-banking applications encourages the use of technology not only by customers but also by banks. Given that banks are not only providers of payment services but also of other financial services, the greater use of m-banking applications, which is currently associated with digital payments, may provide other benefits outside this area, such as the digitisation of internal and other external banking processes (not only payment services). It can be an incentive and an example for greater efficiency in the provision of various banking services and, consequently, for an additional increase in the efficiency of the banking system in our country through the use of information technology.

The popularisation of the use of mobile phones and their applications in payments leads to the formation of new business models and to a better user experience when paying, especially via internet. In addition, the presence of smart mobile devices in everyday life is increasing and contributes to greater possibilities for users when it comes to choosing the time and place to initiate payments. The development of technology enables greater security and simplicity in making payments and using cards, which shows evident results in our market. The domestic card network has recently started issuing chip cards which increase the security of executing transactions at points-of-sale, while international card systems in Serbia have provided contactless payments for card users for many years. They also allow the card to be connected to the aforementioned smart devices and their applications (mobile/digital wallets). Along with the development of retail payments, e-banking, which has been used for high-value transactions for many years, has recorded positive results in the market, increasing the number of users, as well as the number and value of transactions executed in this way. Therefore, card payments, e-banking, m-banking and mobile smart devices are considered as the primary, market-recognised drivers of the expansion of digital payments in the Republic of Serbia.

5 Serbia's Digital Payments Index

A proliferation of initiatives and trends in the field of digital payments is relatively difficult to track. While many of them are extremely interesting, only some products (results of initiatives and trends) live to become massively used among the population, developing a significant impact on payment services and, consequently, on the economy. Digital payments development can generally be divided into digitalisation and digitisation of payments.

Payments digitalisation is a process of creation of a payment service or a payment instrument which provides certain services within a digital format. It is not a rare case that an existing service, relying on paper instructions, is translated into a digital form which may emphasize one or more of their existing features, or create new ones. This is one of the reasons why many payment services experts are not surprised by innovations and may easily offer an

example of a relatively similar service which is not in a digital form. Payment services digitalisation leads to the emergence of a large number of same-type services in payment operations and upgraded features of the existing “analogue” payment services. The upgrades are generally reflected in higher security and simplicity of use of a payment service and easier processing of a larger data quantity (enabling large-scale use of payment services).

On the other hand, digitalisation in itself will not make the service more pertinent to the economy. There are trends of digitalisation of different payment services where a multitude of same-type services compete both between themselves and with other digital service clusters. Looking at market competition between payment services, we need to distinguish the concept of payment service digitisation. Digitisation is a diffusion of digital payment services across the economy. Wishes and abilities (e.g. digital literacy) of payment services consumers also play a part in this process, i.e. their consumer ability to use digital payment technologies in payment, manner of placement of new services, their business models and added value they bring to consumers, as well as many other factors. In a general case, digitisation may be considered to mean the success of spreading of digital payment services. Accordingly, when payment services in a country or region are digitised, this turns out to be only a small part of the work that needs to be done on development of the digital payments ecosystem. In order for the corporate sector to benefit from advantages of service digitalisation, great efforts need to be invested in digital service digitisation to the widest possible consumer base. A digital payment service that is most widely disseminated across the economy is the most important for that economy, while a service that is merely created is as good as a non-existent one.

In order to monitor payment services digitisation in our country, we use the digital payments index (DPI). There is a multitude of indices and analyses aiming to keep track of the digitisation of all or some payment services on a global, regional or local level and to consider in more detail the areas of operation or development of those payment services. In line with that, the Reserve Bank of India recently published its DPI analysing five important areas related to digital payment services provision in that country. The analysis and idea of the Reserve Bank of India have spurred thoughts about creating a similar unit of measurement for the Republic of Serbia.

Given that these are two hardly comparable economies, the DPI model developed for the Republic of Serbia, while resembling in some parts that of India's, is nevertheless unique, and cannot be compared to it. Given the state of play of Serbia's payment services market, some of the indicators captured by the DPI and the manner of their clustering and valuation under the index differ from those in India. While there are some indicator clusters which are identical to those from India's index, they are however universal for every payment services market (e.g. card number, account number, number of POS terminals...).

While the Reserve Bank of India did not specify their index calculation method nor did it explain in detail data monitoring methodology, it can be observed that its index also captures data on cash use (e.g. cash withdrawal). In creating DPI for the Republic of Serbia, any data on use of cash or paper payment orders were strictly avoided.

The DPI did not include elements relating to payments via paper payment orders, such as the in-payment order, out-payment order, transfer order or cheques, or any cash payments. Inclusion of such instruments in the index would create a false picture on digital payments

development, as they could only double the positive effects impacting the index or falsely inflate the index. Aiming to avoid both these effects, these instruments are not considered.

For the sake of explanation, let us consider paper transfer orders. They would have a negative sign in DPI, because a larger number of paper orders means lower payment services digitisation which DPI should monitor. If the number of paper orders were to decrease, with other digital payments indicators remaining unchanged, the index would be falsely inflated (decrease in an indicator with the negative sign produces +), and in case that some of DPI's indicators were to go up by the amount of decrease, a double positive effect would be recorded. DPI captures digital payment services, so positive or negative movements in other payment services/instruments should not impact its value, but only changes in the sphere of digital payment services.

5.1 Definitions and areas captured by Serbia's DPI

Specifically, DPI is a digital payments index focused on digital services of money transfer. Based on DPI movements we draw conclusions on the current state of digitalisation and digitisation of payment services in our country. Further, by revealing factors and influences that shape DPI and its development, it can be concluded which elements serve as drivers or stoppers in digitalisation and digitisation of payments in the Republic of Serbia. Based on such knowledge, public and private agents may make well-informed decisions on their further actions in digital payments. The following payment methods serve as a basis for Serbia's DPI:

- Card-based payments
- Mobile banking payments
- Online banking payments
- E-money payments
- ATM payments
- Direct debit transactions
- Standing order transactions
- Telephone payments

Considering the above, we may offer a final definition of the described concept. **DPI is a unit of measurement showing the evolution of digital payments use in Serbia over time, calculated for the one-year period.**

The index captures:

1. Infrastructure of payment services
2. Degree of technological development
3. Payment performances
4. Consumer experience in payments

The infrastructure can be divided in two areas *i)* the acquiring side and *ii)* the issuance side. On the acquiring side, we look into the indicators related to acceptance of digital payments, enabling consumers to use their instruments in a variety of ways. The issuance side on the other hand relates to channels and instruments facilitating the use of payment instruments for consumers (e.g. payment cards, mobile banking applications etc.).

The degree of technological development relates to influences outside of the wide range of payments operations of a particular country, which impact the execution of digital payments. These include internet connection, mobile phones, general technology use and possibilities to connect technology with payments. For example, internet use in itself has no relevance for payments unless the consumer has opened a bank account. However, if the consumer has such an account and is skilled and capable of using the internet, then there is a possibility to use e-banking and execute digital payments. This is similar to mobile phones and m-banking applications or an m-wallet containing a payment instrument (e.g. card). This cluster includes items that may not be classified as payment services infrastructure, but which are nevertheless extremely important for its use.

Payment performances include statistical indicators of digital payments use in the period observed. They are represented by the amount of transactions carried out through digital channels and the number of transactions executed in the period observed. The number and value of digital transactions are indicative of the cumulative effect of the infrastructure used, factors outside of the scope of the payment system in a broader sense and consumer satisfaction with the current services. Previously mentioned index elements also capture this effect, but their development directly impacts payment performances, while performances on their part do not have such impact on the above elements, but are rather the result of their effective use.

Consumer experience in digital payments means unhindered use of payment instruments for the sake of performance of digital payments. It also includes financial literacy of the population, i.e. the awareness about the availability of different payment methods and their features. This element also analyses buyer i.e. consumer complaints, unauthorised payment transactions etc.

5.2 Methodology

Previously mentioned areas which significantly impact DPI serve to form index pillars:

Possibility of payments

Payment services infrastructure on the issuance side

Payment services infrastructure on the acquiring side

Payment performances

Consumer experience is considered to be the fifth pillar. It is understood as a descriptive parameter, meaning that the values observed within that pillar will not be taken into account when calculating DPI value, though they make an integral part of DPI analysis. The trust and experience of digital payment service consumers are important factors in the process of

increasing the use of these services in the corporate sector, so this data category is observed as part of the analysis of the state of digital payments in the Republic of Serbia.

For the sake of comparison, India's index contains a pillar processing similar data as the above Consumer Experience pillar and according to their methodology, its calculated value is assigned 5% weight in the index formula. As this area of digital payments is by no means negligible, it is understandable that the Reserve Bank of India decided to incorporate it in index formula. However, a quantitative expression of consumer experience (however measured) included into the calculation which uses elements such as the number of payments (in millions), value of payments (in billions) and other, leads to potentially inadequate representation of such data relative to other data clusters. Also, the 5% share in the index could also excessively reduce the impact of this area on payments digitalisation, given that it could entail a marginal impact on changes in index value.

Based on the above reasons, the data cluster aiming to capture consumer experience in DPI is interpreted along with its value, as an integral part of the index, aiming to descriptively grasp the state of play of Serbia's digital payments.

All of the pillars stand for indispensable and mutually interdependent areas of an economy's payment operations. Based on the features of Serbia's payment operations, each of the pillars/areas observed is assigned an appropriate weight in the final DPI calculation formula.

Prior to assigning weights and explaining the reasons for the designed structure, we need to explain how to obtain the unique DPI value. This index is calculated for each year based on the indicators from the above pillars. Each pillar has its value at the annual level calculated based on its respective indicator values. The obtained pillar value is multiplied with the assigned weight and the resulting products are added up to create DPI. In the base year DPI has value 100 and its values in subsequent years are considered relative to the base year, as this is a base index. DPI calculation formula:

$$\text{DPI} = (\text{PILLAR1} * \text{Weight1}) + (\text{PILLAR2} * \text{Weight2}) + (\text{PILLAR3} * \text{Weight3}) + (\text{PILLAR4} * \text{Weight4})$$

For example, if we take 2016 to be DPI's base year (value 100), and then calculate that in 2019 DPI climbed to 200, it means that according to this indicator, the state of play and potential of digital payments in the Republic of Serbia was twice better in 2019 relative to 2016. If it reaches value 300 in 2020, it means that that year saw three-fold improvement compared to 2016. However, its value has not doubled relative to the previous year (2019), i.e. increased by 100 percent or percentage points. DPI is designed in such a way so that its value rises almost exponentially in case of expected development of digital payments and this value should always be observed relative to the base year, in order to avoid confusion in the interpretation. The text below presents data which will further clarify this analysis.

As can be observed in the formula, DPI value depends on weights assigned to each pillar, the formula for the calculation of pillar value and elements incorporated under each pillar. The sum of all weights is one (1). The weights are created based on interdependence between the areas and their impact on digital payments, consistent with the state of play of digital services

in the domestic economy. The formulas for calculating the values of individual index pillars are presented in Annex 1, and the following text elaborates on the main reasons behind the selection of particular data and weights which make up the DPI and their accompanying rules.

5.2.1 Possibility of payments

The first pillar concerns possibility of payments and has the least impact on digital payments compared to other pillars. This pillar offers insight into the availability of internet connection, mobile devices, bank accounts and other factors instrumental for executing digital payments by the population. All the elements under this pillar represent potential preconditions for the use of digital payments, but availability of these elements to corporates/households does not automatically imply higher digitisation of payment services. Consequently, the weight assigned to this data cluster is 0.1 or 10%. Taking all the above into account, the pillar elements are as follows:

1. *Internet.* Internet, i.e. the broadband network with its infrastructure, providers and consumers, has a significant impact on digital payments. As such, it is represented by two indicators within DPI calculation: *number of consumers accessing internet each day relative to the total Serbian population and percentage of households owning internet connection.*
2. *Mobile devices.* Mobile devices may be used in a variety of ways within digital payments, which is why their use is important for DPI. The indicator observed is the *percentage of mobile phone use in Serbia.*
3. *Bank accounts.* Bank accounts, as a pillar element, are used as a *ratio of the total number of natural persons owning at least one current account and the number of the population of eligible age for opening a current account with a bank (16 and above).*
4. *ICT use.* ICT use impacts the ability and interest among the population to execute digital payments, i.e. it has a significant impact on the possibility of digitisation of payment services. Given that internet and mobile phones are already covered, this element is observed as *a percentage of persons to have used the computer over the past three months.*
5. *Digital literacy of companies: website and e-commerce.* Depending on whether they own a website and engage in e-commerce, companies are observed in terms of the *percentage of companies offering online orders or booking of products/services via website.* This indicator is observed as it brings added value to DPI which cannot be compensated for by the pillar incorporating online points of sale. It covers companies which allow for effecting payments via cash on delivery, payment order or in some third manner which however does not lead to the website being registered as an online point of sale in the official statistics and records kept by persons dealing with acceptance in our country.

5.2.2 Payment services infrastructure on the issuance side

The second pillar entering DPI formula concerns the payment services infrastructure on the issuance side. This area covers data on digital payments instruments. Owning any one of such instruments enables consumers to effects digital payments. Since this data cluster is one of the two basic preconditions for the execution of digital payments, it is more relevant than the previously considered area in the first pillar and is therefore assigned higher weight in DPI formula. The weight assigned to this pillar is 0.2 – meaning that 20% of the index value depends on the current status of the payment operations infrastructure used by payers to initiate their payments.

This category consists of the following elements:

1. *Cards*. Cards are currently the most widely used instrument for execution of digital payments. For DPI purposes we observe *a total number of active payment cards with the payment function and the number of cards with the e-money function*.
2. *Electronic banking*. E-banking offers a number of financial services and is currently an extremely popular channel for effecting payments, largely used by legal persons and entrepreneurs, thus influencing digitalisation of payments within business processes in Serbia. DPI uses the *number of e-banking applications* as an indicator of e-banking.
3. *Mobile banking*. M-banking, same as e-banking, offers a number of financial services, and the latest trends in payment services market in our country testify to its becoming an extremely important channel for execution of digital payments. An m-banking indicator monitored for DPI purposes is the *number of m-banking applications*.
4. *Direct debit*. This is a separate payment service enabling payment automation, where a payee, based on the payer's consent, initiates a payment transaction to debit the payer's payment account. The payer may give such consent to the payee, its payment service provider or payee's payment service provider. In our country, this service may be executed, inter alia, via direct debit clearing, operated by the Serbian Banking Association. It enters the DPI value via *the number of contracted direct debits*.
5. *Standing order*. While the standing order service may be initiated by submission of a paper form, without the use of digital channels after making an agreement, it enables consumers to automatically execute payments in future, which may be considered to be a digital payment. Therefore, this category is a digital payment service and its prevalence should be captured by the index. For DPI purposes, *the number of standing orders* is monitored.

5.2.3 Payment services infrastructure on the acquiring side

The third DPI pillar encompasses the acquiring side of the payment services infrastructure. Within this area, data are collected about devices on which the payee uses his digital payment instrument to execute digital payments. This area is primarily concerned with the diffusion of the acquiring network and other devices (e.g. ATMs) enabling payment instrument users to effect their digital payments. Given that the current status of payment operations in the Republic of Serbia is such that users own a variety of payment instruments which can be used to make payments, the diffusion of the network of devices accepting those digital payment instruments may be considered more relevant. Enhancing infrastructure on the acquiring side may have a greater impact on the rise in digital payments than enhancements on the issuance side.

However, one should take into account instruments such as for example electronic banking, which may be viewed as not having the acquiring side, as it uses payment systems established in the economy to execute transactions, influencing digital payments in that way. This means that the importance of the payment services infrastructure on the acquiring side should not be overestimated either. This pillar participates in DPI value with 25%, i.e. is assigned 0.25 weight. The difference of 0.05 between the second and third pillar reflects the previously mentioned slightly higher importance of this pillar in effecting digital payments in the economy, taking into account the characteristics of payment operations.

The infrastructure on the acquiring side consists of three elements: physical and online points of sale and ATMs.

1. *Physical points of sale (POS terminals, applications and other hardware and software solutions)*. Physical points of sale are facilities where payments can be made via some of the existing digital payment instruments in Serbia. This includes payment cards, IPS, electronic money etc. The diffusion of physical points of sale directly impacts the number of digital payment transactions and within this element the index captures *the number of active POS terminals, applications and other hardware and software solutions in Serbia*. This number includes POS terminals, active mobile applications for payment acceptance, mobile devices accepting digital payment instruments (softPOS) etc.
2. *Online points of sale*. Points of sale taken into consideration are those enabling payment via a certain digital instrument such as e-money, payment card, IPS and similar, which are entered in the NBS records. Let us remind that the data on online points of sale which enable only payments via cash on delivery or transfer orders are covered by the first pillar which analyses possibility of payments.

This element monitors the *number of online points of sale in Serbia*. For the purpose of DPI calculation, this number is multiplied by weight 10. This weight is used in order for online points of sale to maintain within the DPI the level of significance they carry in the payment services area in general. The number of POS terminals does not correspond to the exact number of physical points of sale. Large merchants may install several devices within a single facility or own a number of facilities, and there even may be two POS terminals at a single cash

register, while merchants generally have one online point of sale. Technically, an ideal weight would be the average number of POS terminals per merchant in Serbia. Since it is impossible to identify this number, the weight 10 is most appropriate for the need of maintaining the relevance of online points of sale within the DPI.

3. *ATMs*. ATMs enable the service of bill payment via a digital payment instrument, which is a digitalised service. New generation ATMs bring varied payment options to consumers, which qualifies them as an element under DPI pillar. Given that DPI does not monitor payment transactions related to paper orders or cash, the ATM indicator in DPI captures a limited number of these devices, i.e. only *the number of ATMs with credit transfer function*.

5.2.4 Payment performances

The last pillar calculated within the DPI are payment performances. Within this area, the results of digitalisation and digitisation of payment services in the Republic of Serbia and/or data on executed digital payments are monitored. Given that these are the records of executed payments which in themselves may show a large part of the change toward digital payment services of money transfer, this pillar is assigned the highest weight. Payment performances are multiplied by 0.45 weight, which means they impact 45% of DPI value.

For the purpose of DPI, all digital payments are considered equal. Bearing in mind that the index is used for observing the state of play of payment services in the Republic of Serbia – which includes infrastructure on the side of issuance and on the side of acquiring, as well as payment possibilities in Serbia – the number and value of payments monitored by the index are based on dinar payments executed in the country.

Payment performances encompass two elements:

1. *Number of executed digital payments*. The number of executed digital payments pertains to the number of transactions in the time period for which DPI is calculated. This number is defined by taking into account the number of payments by card, e- and m-banking, e-money, standing order, direct debit and telephone payments (see footnote 12).
2. *Value of executed digital payments*. The value of executed digital payments is an element showing dinar value of digital payments executed over the time period for which DPI is calculated. The value of digital payments is defined taking into account the value of card-based payments, e- and m-banking, e-money, standing order, direct debit and payments by telephone.

5.2.5 Consumer experience

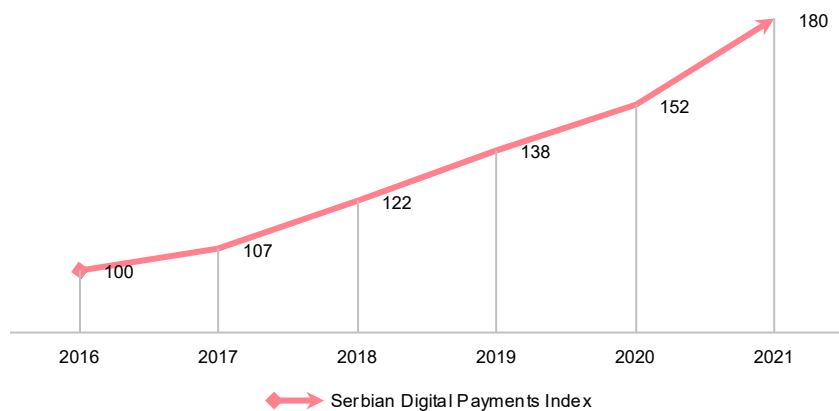
This fifth pillar does not enter DPI calculation, but complements it by shedding light on consumer experience, describing the success and satisfaction of consumers in executing digital payments. An ideal consumer experience would be a digital payment experience with no

barriers, either in the form of internal (systemic) or external factors. In order to measure the degree of positive consumer experience, data are monitored on *i) consumer complaints*, given that complaints describe communication with the population and legal persons /entrepreneurs regarding the problems encountered in the use of payment instruments; *ii) unauthorised payment transactions occurring due to the loss, theft or abuse of payment instrument data*, which are an integral part of payment and therefore impossible to uproot – but with improvement in technology and education they can be minimised, which is a realisable goal; and, finally *iii) consumer preferences*, which may point to different movements in the use of digital payment instruments. While currently there are no data about this element, they could be created in future by using a survey of the population, capturing their wishes, satisfaction and methods of performing digital payments.

5.3 DPI from 2016 to 2021

By using the methodology explained above (pillars, elements and their indicators, mutual interconnectedness of pillars...) we defined DPI value for the prior five-year period. The period observed starts in 2016 which is established as the base year, with index value defined at that point as number 100.

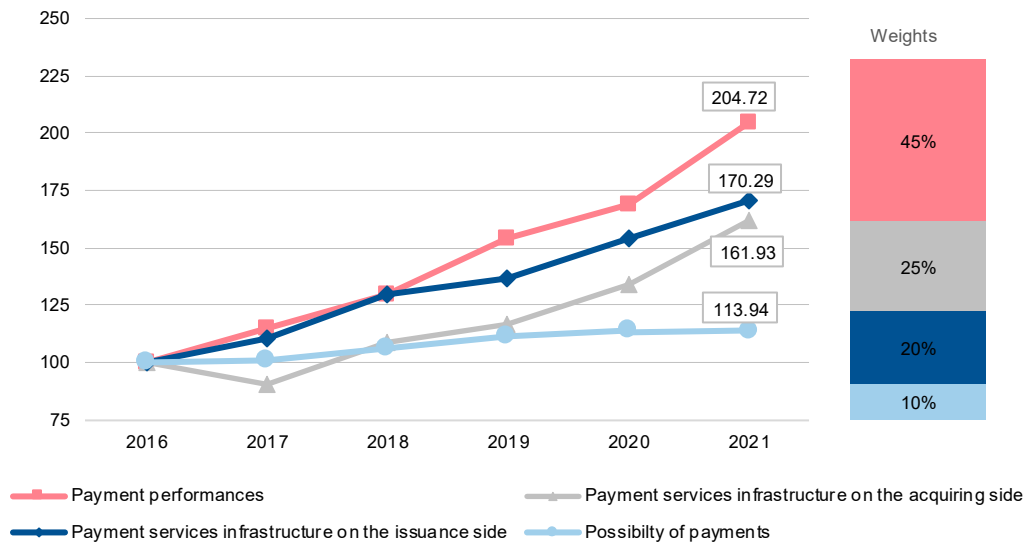
Chart 3 **DPI movement**
(index, 2016 = 100)



Source: NBS.

Chart 3 shows DPI values over time and data in this Chart indicate that the digital payments ecosystem in the Republic of Serbia has recorded constant growth over the past six years. Such trend of development of digital payment services is accompanied by other statistical data collected by the National Bank of Serbia. Given that the index culminates a large cluster of statistical indicators in different payment areas, the constant rise in the index does not imply a constant improvement in all areas which impact it. Data from previous years may show a moderate stagnation in some indicators, and one of the index pillars also declined in value in 2017. Therefore, the index value speaks about the direction of development of the overall digital payments ecosystem and its movement may hide separate movements in individual areas. Given that DPI is based on pillars that capture particular areas, the text below presents the evolution of pillar values since 2016.

Chart 4 **Evolution of DPI pillars and their weights**
(index, 2016 = 100)



Source: NBS.

DPI pillar values have their base in year 2016, when they carried value 100. After 2016, pillar values are observed relative to the base year. Chart 4 and Chart 3 with DPI show the rising trend in the majority of areas which impact the above shown DPI movements. By looking at this visual interpretation we may obtain more detailed information about the reasons behind DPI movements. The text below uses the data from the two charts above to describe the movements in the overall index.

After the base year, the start of the period observed, 2017 saw a decline in the payment services infrastructure of the acquiring side, which had a significant bearing on index result. However, despite this negative movement, DPI experienced growth, though the smallest one recorded in the period observed – of 7 percentage points. The growth stemmed from favourable trends in payment services infrastructure of the issuing side and in payment performances which have the greatest impact of index value. Almost every element on the issuing side contributed to DPI growth, from active payment cards to standing orders, while a negative difference relative to the year before was posted only by the indicator showing a total number of cards with the e-money function. In addition, the number of digital payments in 2017 increased by little less than 43 million transactions, which entailed an increase in the turnover value and these are the key indicators which helped to correct negative movements on the acquiring side primarily reflecting large costs, i.e. fees in this segment of the payment services market.

In the period observed the pillar Possibility of payments had an almost neutral impact, but next year it posted growth which may be considered markable for this pillar. In the period observed this pillar did not undergo major changes, contrary to other pillars, but such movements are expected. The reason lies in the fact that the mobile phone use (the monitored element) has trended high since 2016 and even back then, according to SORS data, 91.8% of the population used mobile phones. Also, the number of current accounts opened in the country

at the beginning of the period observed was high. It should also be kept in mind that it is difficult to abruptly make major changes in basic habits of the population covered by this pillar. The year 2018 saw a more considerable increase in the number of households owning an internet connection and persons who used the computer in the last three months according to SORS data. This is exactly what influenced the pillar movements in Chart 4.

In 2018 these movements were accompanied by the progress in payment services infrastructure on the acquiring side whose growth annulled the fall from 2017 and exceeded the value from the base 2016. The remaining two pillars continued the same, excellent dynamic from the year before, which resulted in a significant increase in DPI, to 122 in 2018. The ecosystem of digital payments services was by one fifth better than in 2016.

After such two-year period, 2019 witnessed a slowed development in the areas observed. This is primarily evident in pillars relating to the payment services infrastructure on the acquiring and issuance side. Such data may be considered an indicator of stable marginal system development. It should be particularly emphasized that the pillar Possibility of payments continues to develop through the element *number of consumers accessing internet each day relative to the total Serbian population and percentage of households owning internet connection*, an indicator posting growth two years in a row. This speaks about the readiness of the Serbian population to accept digital services even before the start of the COVID-19 pandemic. Prior to the pandemic, during the small-scale and stable growth in payment services infrastructure, the number and value of payments in Serbia increased significantly. Payment performances were thus a major driver of the index value. In 2019 it climbed to 138, so DPI proved that digital payments continued up, on the back of the developed infrastructure in existing conditions.

These conditions changed significantly in 2020 and it is very interesting to look at the pillar movements in that period. Namely, the pillar which experienced the most stable and quickest growth until this period, slowed down thereafter. Payment performances increased less vigorously in 2020 due to the COVID-19 pandemic and numerous government measures adopted at the time. Hindered economic activity and shutdowns considerably impacted the evolution of this pillar.

However, as noted in many research papers, the pandemic outbreak had extremely positive effects on payment digitalisation and digitisation. This may be recognised if we observe the pillars related to the payment services infrastructure. There was a large increase in the pillar which monitors the value of payment services infrastructure on the issuance side. The number of active payment cards increased by over 400,000, as well as the number of e-banking users, while the number of m-banking users went up by over 450,000. The acquiring side followed suit by increasing the number of POS terminals and online POS where consumers can make digital payments. In 2020, online POS went up by 77%, i.e. from 1,139 to 2,013 online POS. The pandemic effect is obviously present in the provision of services connected to digital payments, while on the acquiring side this effect was combined with the implementation of the Law on Multilateral Interchange Fees whose implementation in late 2018 triggered a significant decrease in merchant service charges, primarily for the acquiring of payment cards.

The pillar related to possibility of payments posted stable growth in this period, i.e. the consumer base having access to and the ability to use digital services increased even more. As

this pillar did not rise sharply, it may be concluded that the diffusion of digital devices and internet and other elements prerequisite for payment execution was not such a big problem in our country in terms of the further evolution of the digital payments ecosystem. The pandemic outbreak on the other hand induced a change in habits and much greater use of these elements in everyday life which created much better conditions for the development of payment services digitisation and their infrastructure. In other words, the existing potential for digital payment services could be used even better, based on the potential used in 2020 in the form of diffusion of infrastructure and maintaining the growth in the number and value of digital payments. This year's DPI is 152, suggesting that the digital payments ecosystem in the Republic of Serbia improved further in the first year of the pandemic.

The results in terms of the changed consumer habits during the pandemic became evident immediately in 2021, with the number and value of payments posting highest figures on record. The growth rate of the pillar capturing digital payments performances is higher than in other periods observed. Pandemic effects were still felt in 2021, as well as the effects of measures and activities of the NBS, so one observes a further development of payment services market. The increase in value is recorded for both pillars which monitor payment services infrastructure. It is interesting that these two pillars, a kind of base indexes in themselves, are gradually approaching each other. More precisely, the pillar oriented to the acquiring side is catching up with the pillar which covers the issuance side. Given that in Serbia's economy the number of instruments on the issuance side is satisfactory, with a significant base value and faring relatively better compared to acquiring side, such movements are encouraging, speaking about the increasing diffusion of digital payments. The increase in the pillar on the acquiring side means that year after year the population has access to the increasing number of payment instruments. Catching up with and equalisation of the impacts of acquiring and issuance in the economy, i.e. their balance, leads to the maximum utilisation of capacities and even better values within payment performances. DPI has recognised such development of pillars in 2021 as the most optimal, recording the sharpest growth in percentage points. Its value in this period was 180, meaning that the digital payments ecosystem had improved by 80% from 2016. If such pace continues, the results in 2022 could show double improvement from 2016 in terms of the state of play of digital payments.

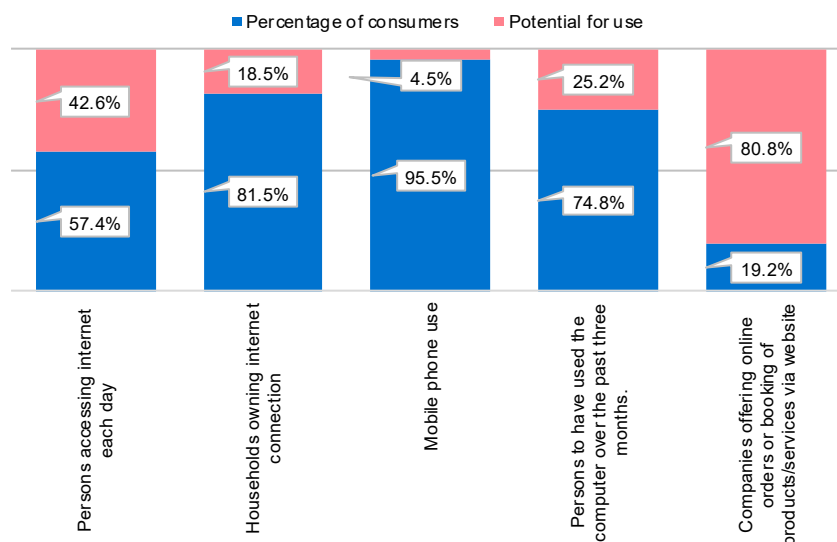
5.4 DPI in 2021

Measured by the DPI, 2021 saw the highest increase in value. This reflects primarily the above positive trends under the pillars Payment performances and Payment services infrastructure on the acquiring side. The areas clustered in such way elucidate the development of digital payments in general, while more information can be obtained by observing individual index pillars and indicators. What follows is an in-depth analysis of the most interesting and most important trends / state of play of elements within pillars for 2021 as this is the last observed year with data that correspond most closely to the current situation in the field of payment services in Serbia.

PILLAR 1 – Possibility of payments

This cluster of indicators was at a satisfactory level for the application of digital payments in 2021. There was a significant percentage of everyday users of the internet, computers and mobile phones, as shown in Chart 5.

Chart 5 **Tapping into and potential of information services user base in Serbia in 2021**



Source: NBS.

Most room for improvement is seen among companies providing the service of online ordering or booking of products/services via their websites. Such potential is important for digital payments given the high value-in-use in online trade. The fact that such potential has not been used even by a fifth, while this year experienced a robust rise in digital payments, stimulates the further development of online trade and encourages all participants who wish to engage in such activity, i.e. provide the relevant services.

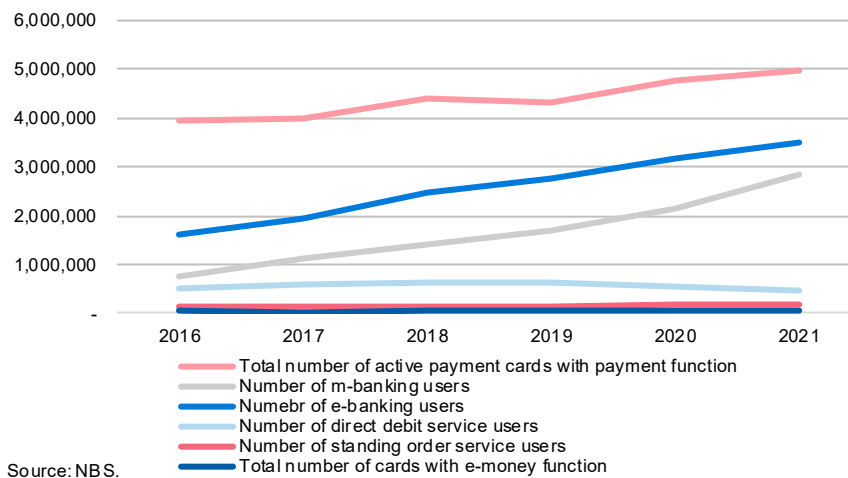
PILLAR 2 – Payment services infrastructure on the issuance side

The issuance of payment instruments was on a rise in 2021. A large number of new m-banking users appeared, and the number of users of e-banking and payment cards continued up at a similar pace as in the past period.

In addition to positive trends, the Serbian payment services market was also marked by negative trends. A decline in users was recorded for payment instruments such as direct debit, standing order and cards with e-money function. Changes in the number of users within the above elements are also shown in Chart 6.

The number of m-banking users rose sharply, from 2,162,362 to 2,840,518, up by 31%. If such trend continues, m-banking users may exceed e-banking users in a few years. In the past three years (2018, 2019 and 2020), the difference between m- and e-banking users equalled constantly one million. In 2021, owing to the above rise, it declined to somewhat more than 650,000 users.

Chart 6 Movement in the number of payment instrument users by year



The trends of use of digital payments in combination with state-of-the-art technologies in the payment field had an obvious effect on our market. This implies, for instance, the use of contactless card-based payments, which spurred the use of payment cards, also supported by the development of the acquiring network in our market (more details are given under the following pillar). In 2021, the number of active payment cards rose by 202,850. In the past two years, the number of active cards was rising. The use of this instrument indicates the improvement of conditions and positive market trends, which mildly stagnated in some of the earlier observed years. The year 2019 even saw a slight decline in the number of active payment cards compared to 2018 (65,309 active cards less).

PILLAR 3 – Payment services infrastructure on the acquiring side

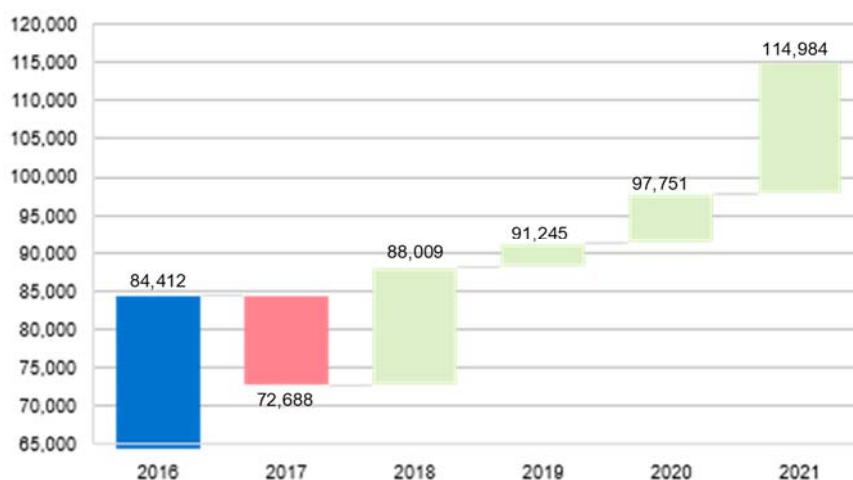
The current period of the development of offer on the issuance side is closely related with the activities concerning the acceptance of payment instruments. In the past several years, the acquiring network in the Republic of Serbia displayed a constant rise, enabling an increasing number of merchants to become part of digital transaction flows.

This rise is reflected primarily in the increase in the number of physical and virtual POS terminals.

The number of POS terminals rose by 17,233 in 2021, which is a significant increase compared to the previous two years. This reflects better market conditions following the adoption of the Law on Multilateral Interchange *Fees and* Special Operating Rules for Card-Based Payment Transactions, owing to which the average fee for the acceptance of payment cards has almost halved compared to the period before the adoption of the Law.

Such movement in the number of POS terminals is also supported by the introduction of a new payment instrument in Serbia within the NBS IPS system. The new method of accepting payments in the market and affordable fees for small merchants also give rise to the increase in the number of payment devices.

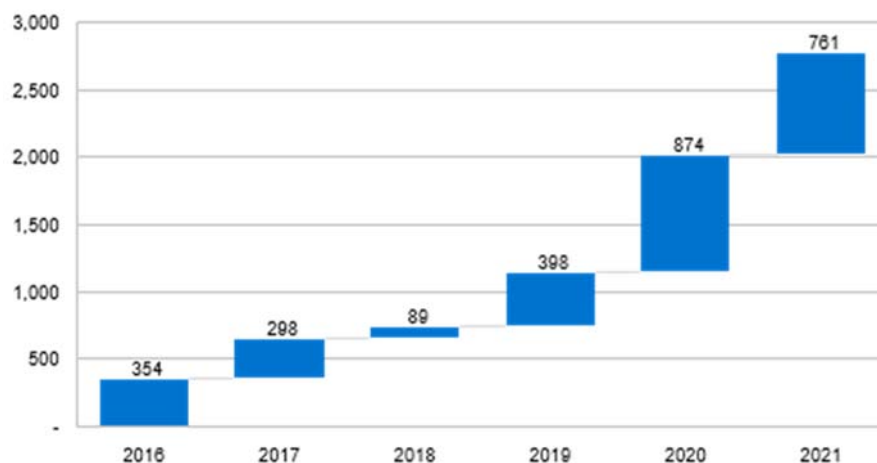
Chart 7 Number of POS terminals by year



Source: NBS.

The rise in the number of brick-and-mortar POS is accompanied with an increasing number of virtual, i.e. online POS. This branch of operation underwent major progress in the past two years, in parallel with the development of new habits and needs of the population. This is also reflected in the number of online POS where users can make digital payments by a payment instrument.

Chart 8 Increase in the number of online POS in Serbia



Source: NBS.

The number of online POS and the dynamics of their development were impacted by the COVID-19 situation, which was also the case with the entire branch globally, as well as by the above relaxation of the level of fees for payment card acceptance and other activities concerning the promotion and further development of payment methods for online trade. This development also includes the operation of the NBS IPS system, which enables payments without leaving any sensitive data on the buyer on the internet. The effects of such development will be particularly pronounced in the coming years.

In 2021, the number of new online stores rose by 761, which is an excellent result. The rise from 2020 when 874 new online stores appeared in Serbia was almost replicated. Such growth has a strong impact on the number of online payments by payment cards, as illustrated below.

Table 1 **Number of online card-based payments**

Indicator	2016	2017	2018	2019	2020	2021
Number of online card-based payments	867,548	1,227,889	2,395,525	5,505,237	12,545,889	20,492,442

Source: NBS.

More detailed data about payment performances are presented hereinafter.

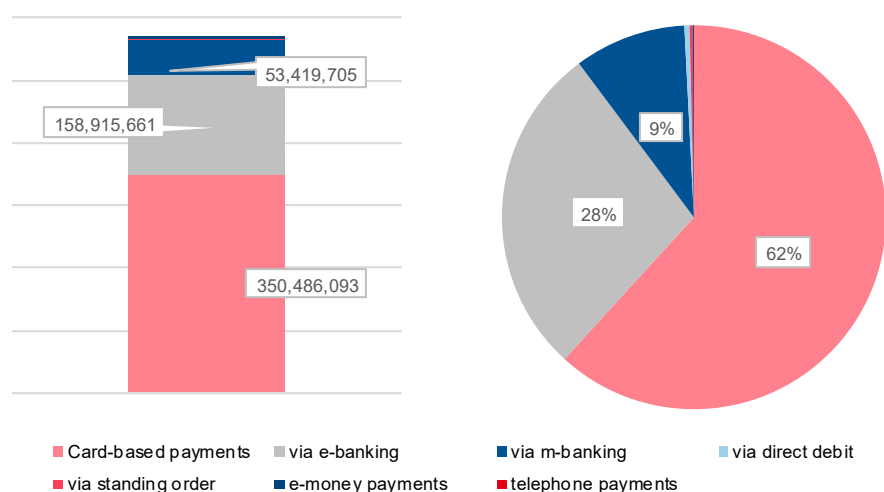
PILLAR 4 – Payment performances

The results of the above situation concerning the acceptance and issuance of payment instruments, including other elements closely related to the increase in digital payments, are reflected in the number and value of digital payments.

Having amounted to 350,486,093, payment card transactions accounted for the major part, i.e. 62% of total digital transactions. E- and m-banking followed suit, with these three categories making up 99% of total digital transactions in 2021.

The constant growth in digital payments in Serbia goes hand in hand with the improvement of the market situation. The above three key categories of digital payments give the main impetus to the growth, compensating for the mild decline in the use of some payment instruments in Serbia. Namely, the number of payments via standing order and direct debit was smaller in 2021 than in 2020 and has a generally mild downward tendency, while telephone payments fell into disuse in 2021 (not a single transaction was recorded). It is worth noting that the number of e-money payment transactions is rising year by year – in 2021 it

Chart 9 **Share of digital transactions in 2021**

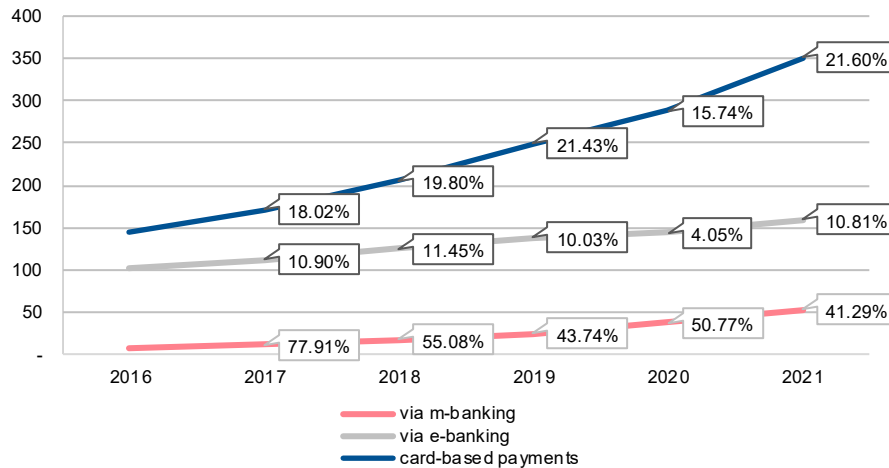


Source: NBS.

increased by over 60% (219,739 up from 2020) although, on the issuance side, the number of cards with the e-money function declined.

Chart 10 Rise in the number of payments in three key digital payment categories

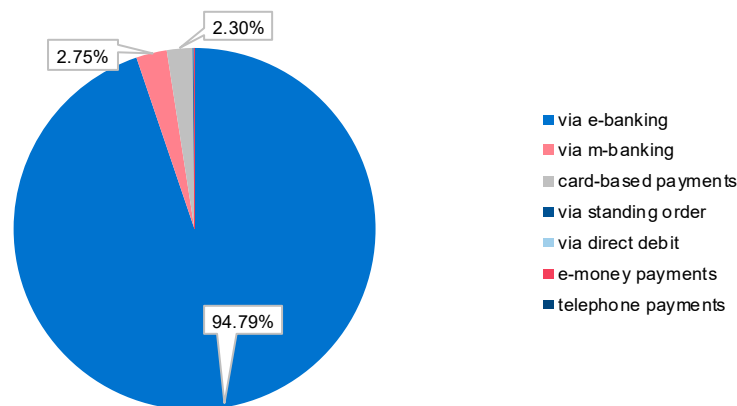
(in mn)



Source: NBS.

Chart 10 also shows percentage increases in the number of transactions recorded each year (compared to the previous year). Data suggest that the highest increase, year after year, has been observed for m-banking transactions. This growth is partly supported by a very small base of the number of m-banking transactions, which equalled only 6,323,088 in 2016. On the other hand, the development of card-based payments and exceptionally high growth percentages suggest that, in terms of the frequency of use of digital payments, card-based payments hold the first place next to other payment instruments, and will probably keep this position over the next few years.

Chart 11 Share of digital payment categories by value in 2021



Source: NBS.

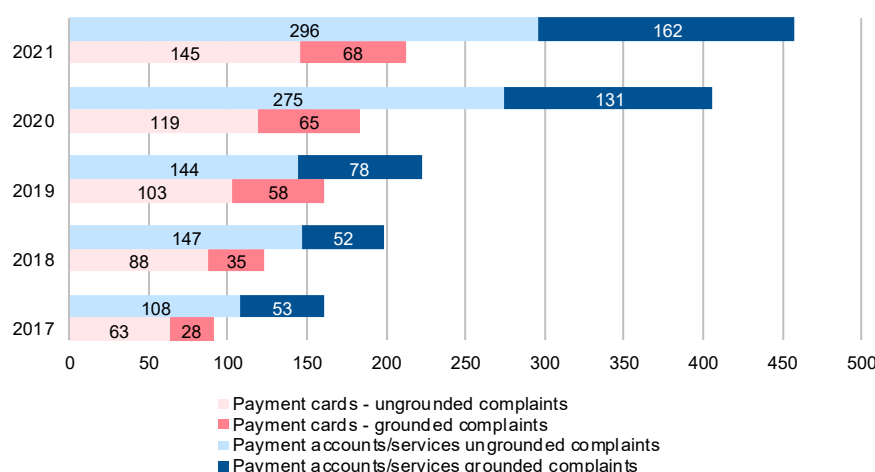
Despite a high share of payment card transactions, the value of digital payment transactions doubtless belongs to e-banking transactions. Given the nature of this instrument and the manner of its use, such statistics is expected. E-banking makes up over 94% of the value of digital payments in our country.

PILLAR 5 – Consumer experience

The use of almost all digital payment instruments implies previous knowledge (very often digital literacy) and largely depends on the simplicity of the process that these instruments provide to their users. To monitor user dis/satisfaction in relation to digital payments, the number of user complaints concerning the use of payment instruments is followed, as well as the number of unauthorised payment transactions in relation to the method of execution.

In 2021, users filed the highest number of complaints relative to previous years. There was also a rise in the number of grounded and ungrounded complaints concerning the use of payment instruments. Such situation is expected given a constant rise in the number of digital payments and users who have access to payment instruments. In 2021, the number of grounded complaints concerning the use of payment cards was only 68, vs. 65 in 2020, which is not a significant increase. The number of complaints concerning payment accounts / other payment services also increased – grounded complaints rose from 131 in 2020 to 162 in 2021.

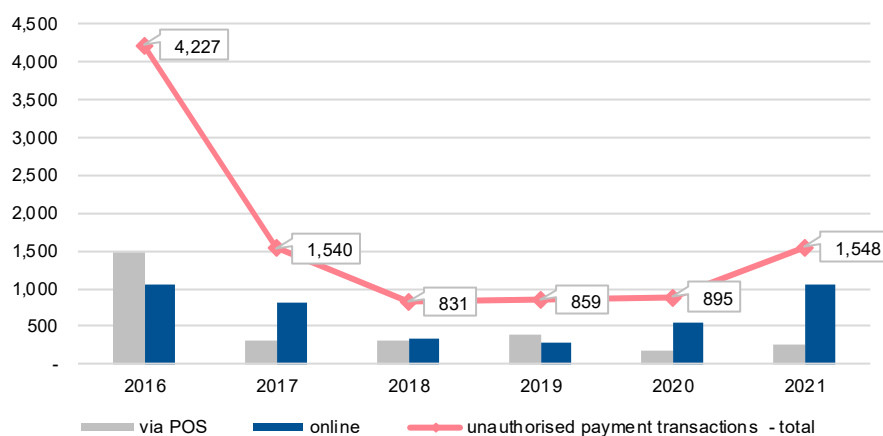
Chart 12 **Dynamics of grounded and ungrounded complaints concerning the use of payment instruments, by type**



Source: NBS.

Along with the rise in the number of consumer complaints, last year saw an increase in unauthorised payment transactions in Serbia due to a loss, theft or abuse of payment instrument data. According to data submitted to the NBS by banks as part of their regular quarterly reporting, the number of reported unauthorised payment transactions increased from 895 in 2020 to 1548 in 2021. However, this growth was almost three times lower than in 2016 – 4227 unauthorised payment transactions. The DPI follows the number of unauthorised payment transactions related to the internet and POS terminals. The fact that their number on the internet almost doubled indicates the need for greater education of the population in relation to online purchases and use of payment instruments on the internet.

The user experience analysis lacks data from the proposed population survey within defining of DPI elements. In case the survey is carried out in the coming period, the information obtained would complete this DPI area.

Chart 13 **Unauthorised payment transactions at POS terminals and online**

Source: NBS.

Given the above stated, the ecosystem of digital payments in Serbia, presented through the DPI, recorded the highest growth in 2021. This is testified by the positive dynamics of most indicators. Last year, the number of digital payments at online POS increased significantly, and is entirely justified to expect the continuation of such trends in the coming period. The year 2021 also experienced a large, 31% increase in m-banking users, which indicates the prevalence of mobile applications in the ecosystem of cashless payments in our country. This may be an important business signal for many companies/startups in the area of software engineering with a focus on mobile phones. Owing to its constant expansion, the acquiring network enables an increasing number of merchants to join the digital payment flows. In addition to the increase in the number of POS terminals, which are at the same time increasingly state-of-the-art, the rapid development of new online stores in 2021, almost equal to the huge increase in this indicator amid COVID-19 pandemic last year, had an exceptional influence on the DPI value. We expect that online stores, which due to changed consumer habits became one of focal points of the development of digital payments, will in future provide a vigorous impetus to the DPI increase. Finally, although there are payment instruments, i.e. indicators within the index, which in 2021 experienced a decline in popularity (standing order, direct debit...), a significant rise in other instruments and their indicators more than offsets these marginal declines, which is why the total impact of indicators on the DPI value was positive in 2021. The highest rise in the DPI was recorded in 2021 owing to the exceptional results of a large number of indicators.

6 Conclusion

Digital payments are undergoing constant evolution owing to continuous interaction of payment services providers, information technologies and needs of end-users. Owing to such development and embracement by users, the digitalisation and digitisation of payment services are taking place, giving rise to the need to cover and analyse trends, results and final effects of this process on the economy.

Based on the large number of data on various forms of digital payments globally and particularly in our country, which have been analysed in this paper and adequately contextualised, it is possible to confirm a multiple-year progress in the field of digital payments in the Republic of Serbia.

As presented in the paper, digital payments have gone a long way in terms of their development. Starting from 2020, the COVID-19 pandemic also doubtless had a positive impact on the accelerated embracement of digital and contactless forms of payment, and it significantly influenced user preferences. The popularisation of the use of mobile phones and mobile payment applications also results in new business models and improves user experiences during payments, notably online. In parallel with the development of retail payments, e-banking, which is generally used for large-value payments, has been recording positive results in the Serbian market over a number of years already – the number of users and value of e-banking transactions is increasing. For these reasons, card-based payments, e-banking, m-banking and mobile smart devices can be considered primary, market-recognised elements for the spread of digital payments in Serbia.

With the DPI of Serbia, presented in this paper, an attempt was made to measure the success of the spread of digital payments in our country. It is designed in such way that digital payments in the country are followed through five key dimensions, i.e. four pillars included in its calculation (possibility of payments, infrastructure on the issuance side, infrastructure on the acquiring side and payment performances). Being a tool that captures the situation and development of digital payments in a concrete time period, the DPI provides unique value added to all hitherto analyses of this area.

Starting from 2016, which is taken as the base year for the DPI, the measurement and analysis of the results achieved indicate that the digital payment ecosystem has been recording a constant rise in the past six years. The results concerning a change in consumer habits during the pandemic can be observed through the index movements in 2021, in which the number and value of payments were particularly pronounced and recorded the best results in the period under review. Such results are also supported by the introduction of the new payment instrument in Serbia within the NBS IPS system, as well as other innovations and business models encouraged by the system. Market innovations are accompanied with the expansion of the acquiring network with the increase in the number of brick-and-mortar and online POS. In the past two years, online POS have recorded considerable progress, consistent with the development of new habits and needs of the population, which was also recorded within the DPI value. The development of online stores was also backed by the operation of the NBS IPS system, which enables payments without leaving any sensitive data on buyer's payment instrument on the internet, an increased use of payment cards and generally more frequent use of technology and the internet by people – the indicators also followed by the DPI.

The development of the DPI for Serbia marked a new, extensive attempt at covering and analysing all relevant digital payment areas and adequately valuing their mutual relations. This concept doubtless remains modifiable in line with future development trends, potentially non-coverable by the existing methodology, which entails necessary flexibility. Still, this is an all-

encompassing method for the analysis of digital payment development in Serbia through time, which can – by meeting the current information needs of all stakeholders – serve as the method of long-term monitoring and as an autonomous data source for future research.

Appendix

DPI calculation formulas

To calculate the DPI, each of its pillars was assigned a weight based on its importance for the digitalisation and digitisation of payments in Serbia. Based on those weights, the following DPI calculation formula was devised:

$$0.1 * \text{„Possibility of payments“} + 0.2 * \text{„Infrastructure-issuance“} + 0.25 * \text{„Infrastructure - acquiring“} + 0.45 * \text{„ Payment performances “} = \text{DPI}$$

The method of calculation of values of individual DPI pillars is shown below:

Possibility of payments

	(Number of persons accessing internet each day in the past three months of the year /total Serbian population)
+	Percentage of households owning internet connection
+	Mobile phone use
+	(Number of inhabitants (aged 16+) / Number of users owning at least one current account in Serbia)
+	Percentage of persons to have used the computer in the past three months
+	Percentage of companies offering online orders or booking of products/services via websites
<hr/>	
=	Possibility of payments

Payment services infrastructure on the issuance side

	Total number of active payment cards with the payment function
+	Total number of cards with the e-money function
+	Number of m-banking users
+	Number of e-banking users
+	Number of users of direct debit service
+	Number of users of standing order service
<hr/>	
=	Payment system infrastructure on the issuance side

Payment services infrastructure on the acquiring side

$$\begin{aligned} & \text{Number of POS devices} \\ + & \text{Number of online POS} * 10 \\ + & \text{Number of ATMs with the credit transfer function} \\ \hline = & \text{Payment system infrastructure on the acquiring side} \end{aligned}$$

* In making the calculation for this pillar, the number of online POS is an indicator multiplied with weight ten, given the nature of online POS.

Payment performances

$$\frac{\text{Number of payments (current year) / Number of payments (base year) + Value of payments (current year) / Value of payments (base year)}}{2} = \text{Payment performances}$$

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Abbreviations

ATM – Automated Teller Machine

GDP – Gross Domestic Product

BIS – Bank for international Settlements

IBM – International Business Machines

DPI – Digital Payments Index

NBS IPS – Instant Payment System of the National Bank of Serbia

NBS – National Bank of Serbia

NFC – Near Field Communication

PIN – Personal Identification Number

POS – Point of Sale

SORS – Serbian Statistical Office

TSR – Total Shareholder Return

COVID-19 – coronavirus

QR code – Quick Response Code