

Ministry of Education and Science of Ukraine

# ODESA NATIONAL UNIVERSITY OF TECHNOLOGY

International Competition of  
Student Scientific Works

# BLACK SEA SCIENCE 2023

## PROCEEDINGS



ODESA, ONUT 2023

Ministry of Education and Science of Ukraine

Odesa National University of Technology

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# **BLACK SEA SCIENCE 2023**

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**PROSPECTS FOR THE DEVELOPMENT OF CONTACTLESS  
PAYMENT IN THE CONDITIONS OF DIGITALIZATION OF THE  
BANKING SYSTEM**

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**Abstract.** *Contactless payment technologies play an important role in the process of the system of bank settlements in the whole world, and in particular in Ukraine. At the same time, there is a problem of public refusal to cash in favor of contactless payments. The purpose of the article is to study the role and place of contactless methods of calculation in the economy of Ukraine and the world in terms of novelty and profitability, as well as to determine trends of their application.*

*In the work, the tendencies of the introduction of contactless payments into the world banking system, and directly Ukrainian are analyzed. Strong, and weak sides, opportunities, and threats to the development of such technologies in the modern economy are identified. A survey was conducted among Ukrainian society on their attitude to contactless payments and identified the main obstacles to the dissemination of these technologies in Ukraine. Ways of solving the problem of digitalization of the banking system of Ukraine were proposed.*

**Keywords:** *NFS technology, contactless payment, tokenization, face recognition payment, mobile payment, and QR-code payment.*

## **I. INTRODUCTION**

Payments using bank cards, smart applications, and direct contactless payments are of great importance in the accumulation of funds in banking systems, which give users new profit opportunities and increase the transparency and reliability of the financial system in general.

The systems of contactless payments are now actively developing, and their use has a very significant perspective in the whole world and Ukraine in particular. The tendency of increasing the number of bank cards with the built-in NFC chip, as well as the growth of the size of POS terminals, gave Ukraine bonus advantages over the countries of Eastern Europe, which enabled it to quickly introduce Google pay and Apple pay systems into the Ukrainian financial sector. The leading trend in the development of the modern economy of developed countries is the development and perception by users of the newest instruments of financial calculations. Of course, contactless payments, which have become a substitute for old cash payments, are more effective and more productive, and they also have a much greater degree of protection. Leading countries such as Sweden, the United States, Japan, and China, are reducing the amount of cash flow in the everyday life of the population. They actively stimulate the development of the infrastructure of contactless cards, the use of Internet-wallet, and Internet payment.

With the start of COVID-19, the process of payment systems' digitalization became one of the main missions of society. Global, concern about infection and the

role of the permits in spreading emphasized the need for contactless payments. Popularity began to acquire contactless payments, which exempt users from the congenic burden and minimize the term in processing transactions quite significantly. This growing ecosystem further offers a safe and convenient way to conduct cashless transactions. According to a global Mastercard survey conducted in April 2021, about 8 out of 10 consumers report that they are using contactless payments. From 46% to 52% of clients changed the standard bank card to the one offering contactless payment. Most consumers consider contactless payment as a clean and faster method of payment since it allows them to carry out transactions 10 times faster than other payment methods. This allows clients to make more quick and comfortable settlements in different types of institutions [1].

## **II. LITERATURE ANALYSIS**

Given the relative novelty of this topic, we still have no significant theoretical basis for Ukrainian works, but we can select the research conducted by L. P. Bondarenko, N. B. Yaroshevich, A. B. Tarabynov, and others.

Studies of various aspects of contactless payment methods were covered in a considerable number of foreign works by scientists O. Gough, R. Boon, J. LIM, Z. Dubinsky, D. Clark, A. Jeffries, and A. Villarreal.

## **III. OBJECT, SUBJECT, AND METHODS OF RESEARCH**

The main purpose of the work is to study the general tendencies of the introduction of contactless technologies in the economy as a stage of the banking system's digitalization and analyze the readiness of the Ukrainian society to transition to contactless methods of payment, to identify the main obstacles to this process and their solution.

The tasks of the work are:

- analysis of the international situation in the sphere of the use of contactless payment methods, investigation of the trend of their development, and identification of the main advantages of the use of contactless payment methods.
- measuring consumer benefits in the sphere of payment and determining the main obstacles to the integration of the latest payment technologies into the Ukrainian economy.

The object of scientific work is non-contact payment under the conditions of the digitalization of the banking system of the world and Ukraine.

The subject of scientific work is the assessment of the effectiveness of the non-contact payment system implementation in Ukraine and the determination of its interference.

The following methods were used during the study:

The survey, analysis and synthesis, graphic methods, method of scientific abstraction, method of systematization, as well as of inducement and deduction.

IV. RESULTS

**4.1 Trends in the development of the system of contactless payments as a stage of the banking system’s digitization. Analysis of prospects and disadvantages of their use.**

The concept of contactless payment refers to the possibility of payment using a card or electronic device, holding it near the payment terminal of the seller. In 2022 these two benefits were considered one of the most advantageous factors of card payments. When making a payment with a contactless card, checking the card information with a chip and a PIN code is important before the transaction. The highest transaction cost limit was increased to a legal level of €50 per transaction in all euro-zone countries in 2019. A PIN can also be required after a certain number of transactions per day or when the total amount has been reached, making contactless payments more reliable against fraud. Contactless card payments in POS increased from 41% of all card payments in 2019 to 62% in 2022 [2]. The change of habits is significantly different between different countries of the euro area. Lithuania was the only country where contactless payments as a share of the total number of card transactions decreased from 54% to 53%; however, this should be treated with caution because of possible margin errors. Cyprus was a country where contactless payments had the highest share of total card payments in 2022 (88%), followed by Slovakia (84%) and Greece (84%). Belgium was the country with the lowest share of contactless card payments in 2022 (39%), as it was in 2019 [2]. Germany in particular saw a significant increase in contactless payments as a share of total card payments, although it should be noted that the first point of data for Germany is from 2017, not from 2019 (Fig. 1).

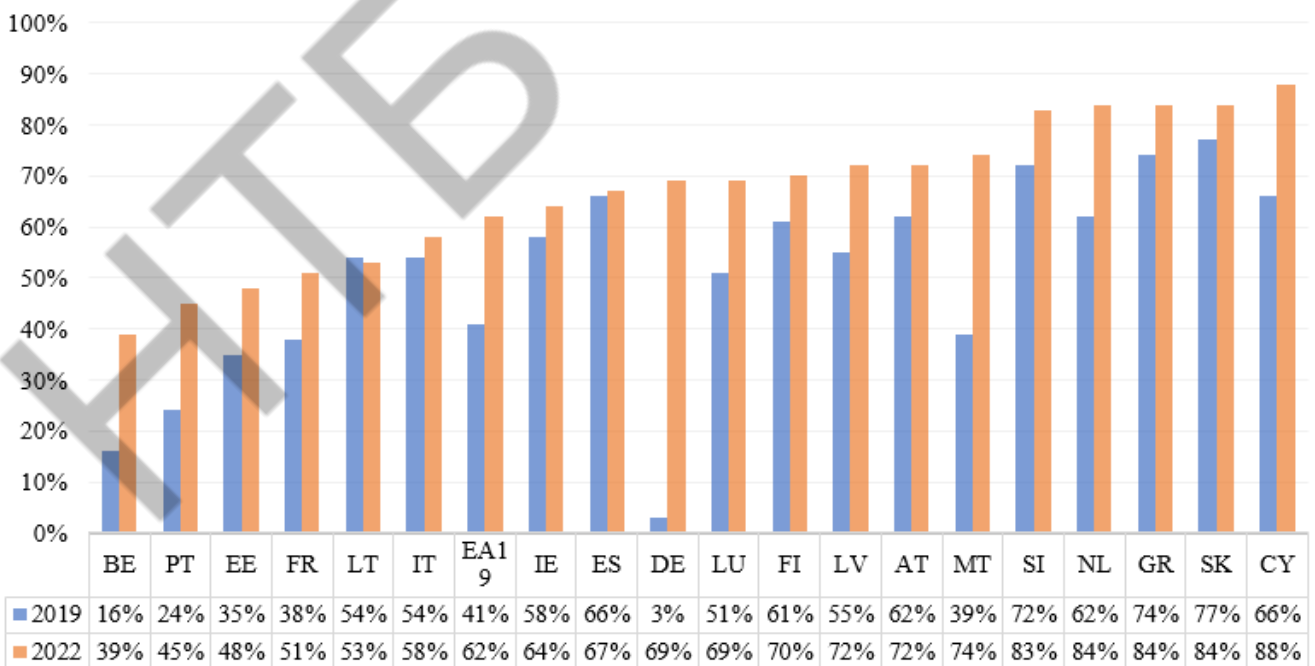


Fig. 1. Share of contactless payments in all card payments at the POS in terms of number and value of transactions, by country in the period of 2019-2022

Sources: Based on [3]

When it comes to the cost of non-contact payments operations compared to the total cost of card transactions, the share of contactless payments increased from 27% to 50%. Greece and Finland were the only countries that saw a share in the value of non-contact agreements, down from 75% to 69% and 36% to 35%, respectively. Three countries with the highest percentage of contactless card payments in 2022 were Cyprus (81%), Slovakia (75%), and Slovenia (74%); Belgium has the lowest index (28%) [2].

In 2020, digital payments in general tended to grow rapidly. According to Capgemini's World Payment Report [4], digital payments grew by 53% (Fig.2).

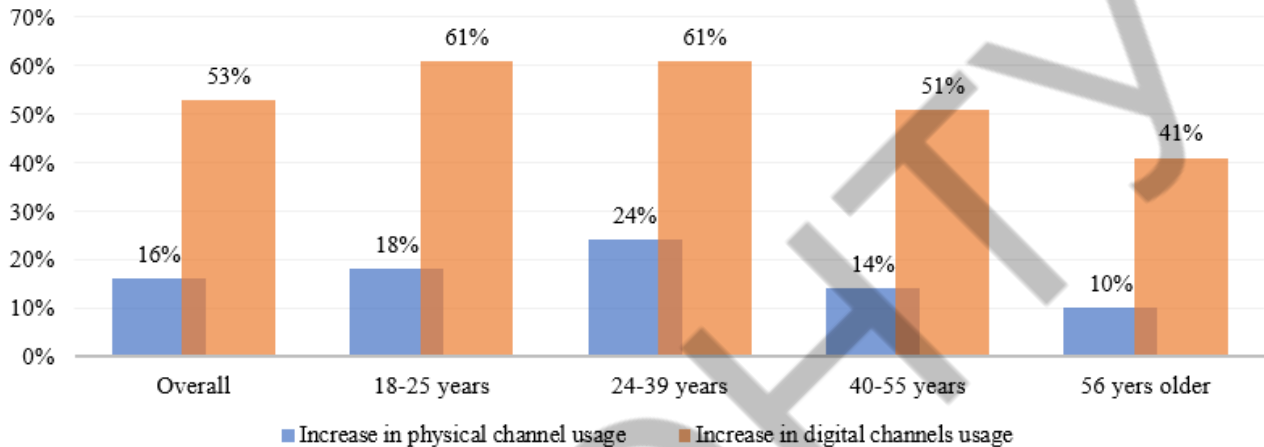


Fig. 2. The level of adapting digital payment compared to physical payment in 2020

Source: Based on [4]

It is worth noting that clients also experimented with new forms of payments, including:

41% tried contactless cards.

35% added the card to the digital wallet.

27% of clients experimented with QR code payments [5].

From all regions, APAC had the highest volume of global non-cash transactions, reaching 243.6 billion transactions in 2019 - a growth rate of 24.7% in just one year. In the EU, non-cash transactions increased by 12% from 2018 to 2019 (Fig. 3).

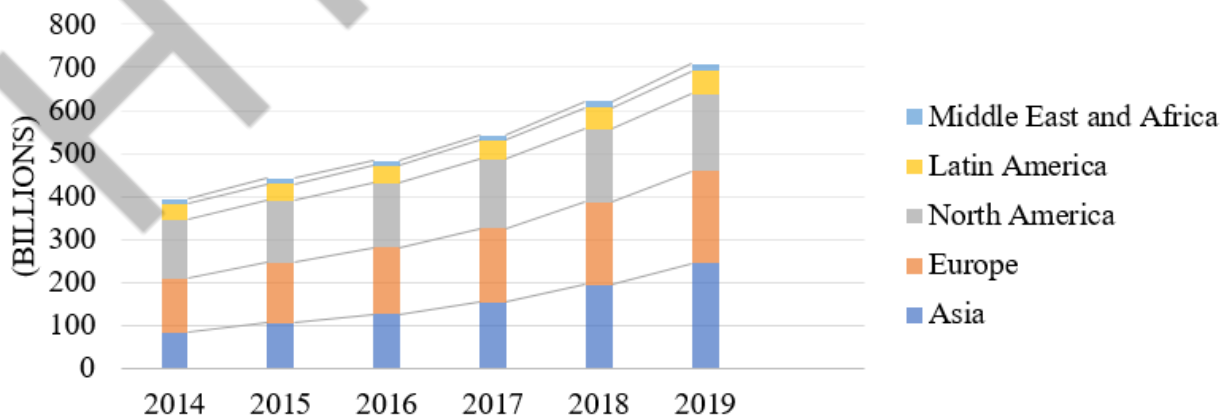


Fig. 3. Non-cash transactions around the world in the period of 2014-2019 (billions)

Source: Based on [1].

It is worth noting that credit and debit card payments are still dominant in eCommerce payments, and mobile payments are expected to reach the fourth [5].

Advantages for consumers:

- Fast, convenient, and safe payment for low-cost purchases – perception of safety and convenience stimulated the preference for contactless cards. Around the world, almost half of the respondents (46%) have changed their standard bank card to one offering contactless payments – this share is growing up to 52% among those under 35.

- No effort is needed, or a PIN code is ideal for customers who save time. The global pandemic has led to increased consumer concern about cash use and the benefits of non-cash payment. Most respondents (82%) say contactless payments are a more hygienic and safe way of payment, and contactless payments are 10 times faster than others, which allows clients to save time when paying in the appropriate institutions.

- Convenience for public transport, motor transport, parking facilities, petrol stations, and pharmacies. There is no need to wait in long queues for purchasing a metro ticket, leave the car to get a ticket for its parking, and so on, just to put a non-contact payment and the operation is completed.

- Use of mobile wallet for transactions. You do not need to stand in line for everyday purchases – fast service when buying food and drinks, entrance tickets for entertainment establishments, and shopping in shops [6].

Benefits for enterprises and businesses:

- Faster transactions effectively move customers through the payment process – generating the potential to increase sales.

- Modernized payment processes reduce operating costs and increase efficiency.

- Increased customer expenses, increased frequency of purchases, increased loyalty – contactless payment function encourages consumers to frequently use debit cards. Once consumers have access to contactless technology, the frequency of transactions with debit card points of sale is increased by 7% per year [7].

However, there are a significant number of vulnerable places of the contactless payment system, the following risks and ways of their solution [8].

Table 1. RF Vulnerabilities: Attack Patterns, Risks, and Countermeasures

Vulnerability	Attack	Attack Set-up	Risks	Countermeasures
A legitimate contactless payment transaction can be captured using a clandestine antenna	Passive Eavesdropping	Spy-reader near-read data exchanges	Leakage of card account data Leakage to manufacture a fake card or a clone	Encryption of data exchange Authenticate contactless card

<b>Contactless card responds when it detects a 13.54 MHz frequency</b>	Clandestine scanning/ Electronic Pick Pocket/ Skimming Replay Attack	Clandestine reader in proximity with the contactless card Skimming for replay attack (using predetermined challenge)	Retrieval of data for cloning Initiation of the fraudulent payment order	Reader authentication Online authorization Quality Random Number
<b>POS is confused if it has authenticated remote chip instead of presented</b>	Grandmaster Chess/ Replay/Man-in-the-middle Attack	Fake Card for carrying MITM attack Using skimmed original cards	Unauthorized Payment	Binding transaction time foils replay attacks as it takes extra time
<b>Weak Crypto implementation due to limited processing power &amp; battery</b>	Brute Force Attack	Brute Force Tools to read data	Eavesdropping transactions for card cloning	Lightweight crypto is standardized. It takes care of this attack
<b>Activating all cards in proximity leading collision</b>	Denial of Service Attack	Activating multiple cards	Disruption in transaction processing	Standardization like ISO 14443 solves collision problem

Source: Based on [9]

#### 4.2 Definition of prospects and obstacles to the introduction of contactless payment method in the Ukrainian banking system

In recent years, Ukraine has experienced a real payment revolution. We have long been accustomed to using a bank card anywhere and without any additional fees – and at the same time to receive cash and other bonuses for purchases. BA more, do not necessarily even have a physical card. You can pay for the purchase by phone, any gadget, and even your face. According to the results of May 2022, the total number of issued payment cards in Ukraine reached 103,6 million units. This is 13% more compared to the pre-war January 2022.

At the same time, in May 2022, compared to January of this year, the number of payment cards with which the expenditures were carried out every month was reduced. Their number decreased by 11% – out of 48,2 million units. in January up to 42,8 million pieces. in May [8].

Despite the decrease in the total number of contactless and token payment cards (by 6% and 15% respectively), their popularity among Ukrainians is very high. The total share of contactless and token payment cards among all active cards is 60% (this year in January – 58%) [8].

In general, today the token is approximately every sixth active payment card (at the beginning of January – approximately every seventh); the contactless payment card is about every second (as at the beginning of January).

As a result, less than a fifth of transactions (18,2% in amount and 16% in quantity) were carried out in the trade network with a physical reading of data from the

card carrier. Other transactions were contactless (with a contactless card or with smartphones and other gadgets). Their amount this year in May amounted to UAH 79,2 billion [10].

We surveyed the prevalence of the contactless payment method and the main problems of its implementation. The research was conducted among students of Ukrainian universities since this group of the population is considered the most progressive in the field of technology and is open to new. In total, more than 150 respondents took part in the survey. We have studied their payment habits and attitude toward various payment instruments and financial services. We want to share the results and our conclusions.

Taking into account the results of the Payment Method Survey (Fig. 4), it is possible to conclude that the majority of respondents prefer a contactless payment method, and only 7% use cash or contact cards (12%)

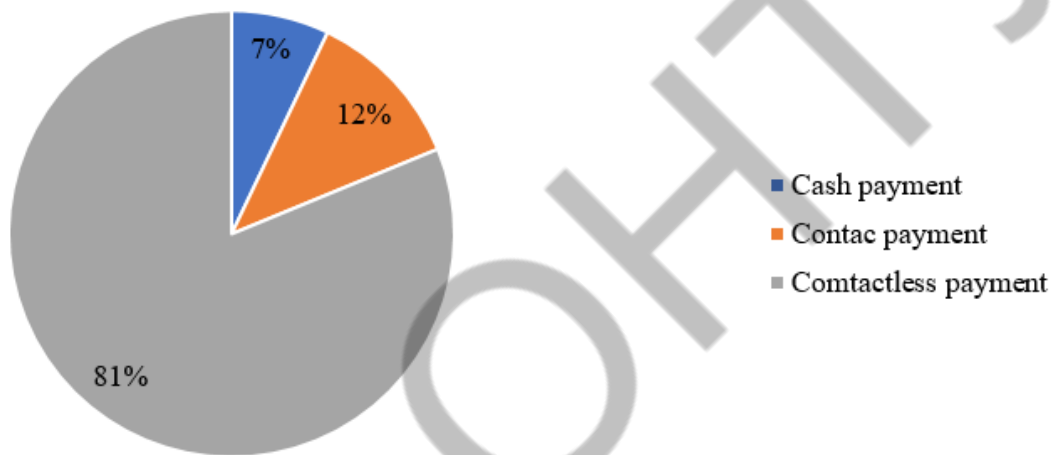


Fig. 4. The results of the survey “What payment method do you prefer?”

Source: Based on the research conducted by the authors.

According to the results of the survey on the change of payment methods with the onset of the pandemic (Fig. 5), it is possible to emphasize that almost half of the respondents changed their payment habits exactly under the influence of COVID-19.

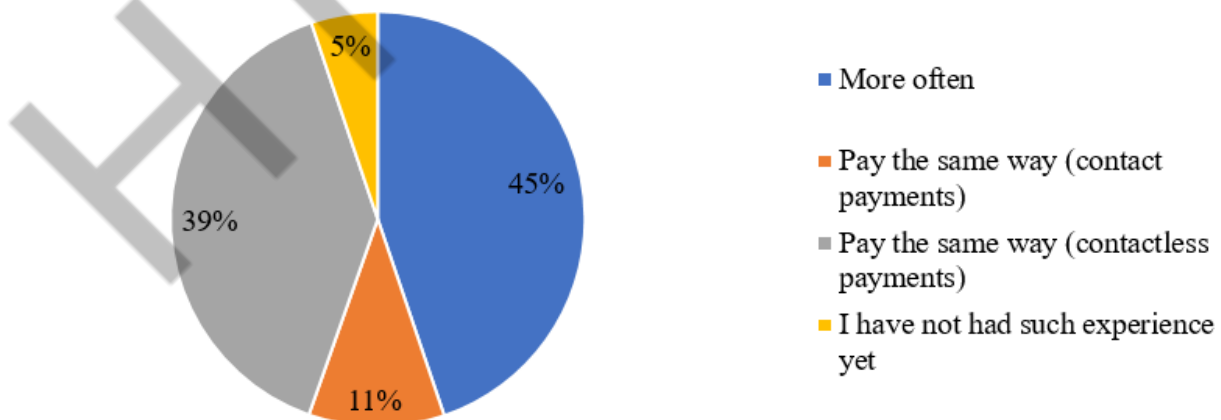


Fig. 5. Results of the survey on increasing the use of contactless payment methods with the onset of the COVID-19 pandemic.

Source: Based on the research conducted by the authors.

According to the results of the survey “How often you have faced the situation of lack of devices for maintenance of contactless?” (Fig. 6), one can conclude that one of the main obstacles to the transition to contactless payment methods is the absence of appropriate devices for their maintenance.

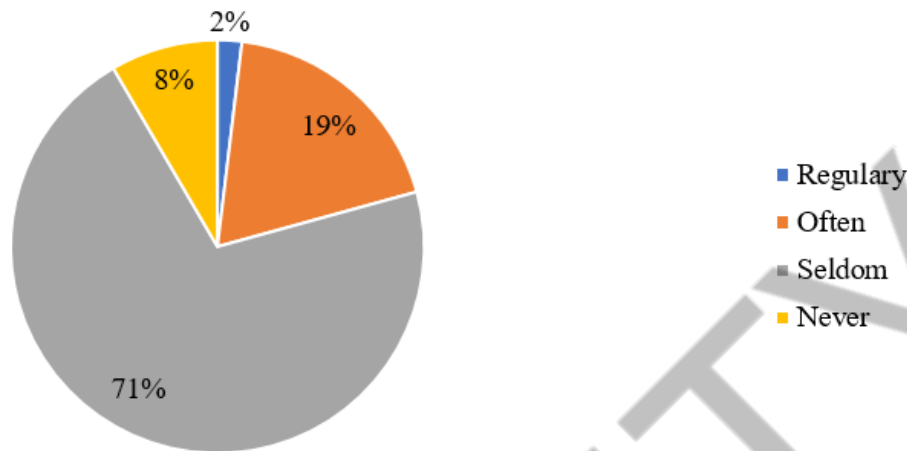


Fig. 6. Results of the survey “How often you have faced the situation of lack of devices for maintenance of contactless?”.

Source: Based on the research conducted by the authors.

The banking system has not reached the stage of devitalization, but still cash plays an important place in the economy of Ukraine (Fig. 7). Still not everywhere can afford a cashless payment method, and as a result, clients are not ready to give up the cash.

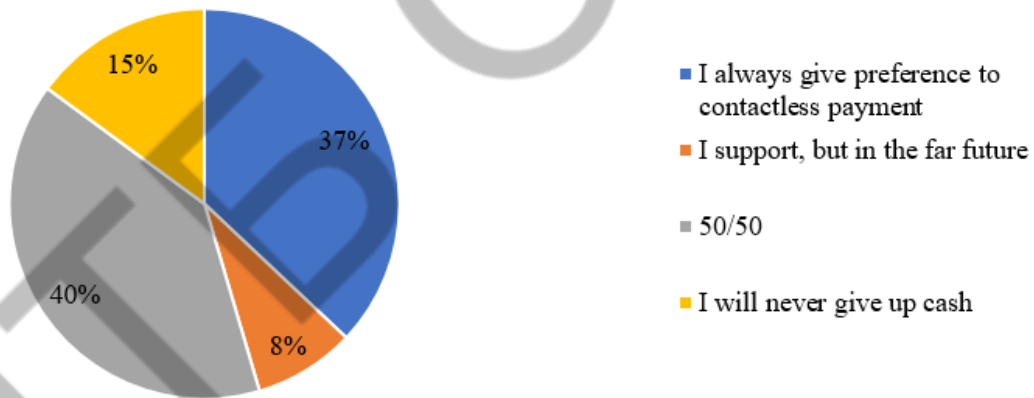


Fig. 7. The results of the survey “How do you feel about the refusal of cash in favor of contactless payment?”.

Source: Based on the research conducted by the authors.

The survey results show that 34% of respondents are ready to replace their bank cards with contactless cards, while 56% have already done so (Fig. 8).

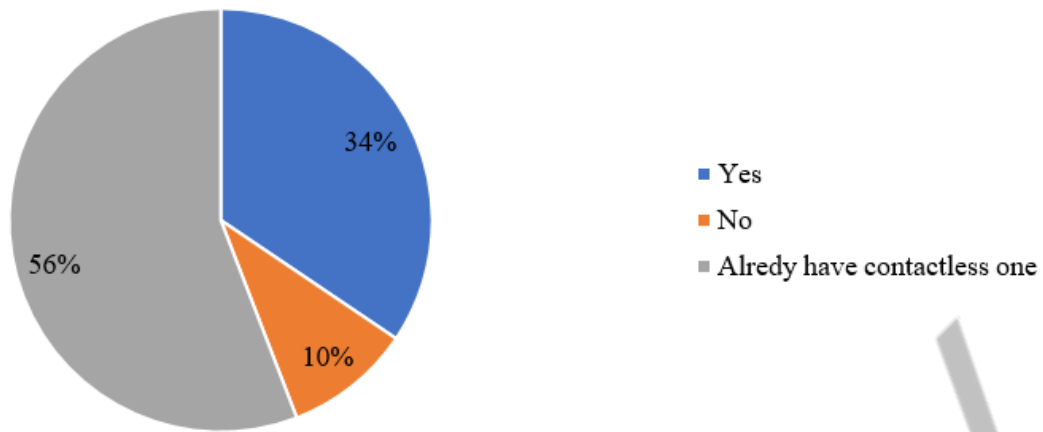


Fig. 8. Results of the survey “Are you ready to replace your top-of-wallet card with a contactless one?”.

Source: Based on the research conducted by the authors.

According to the survey on 20.01.2023 (Fig. 9), the arrival in Ukraine of Apple pay and Google pay has become a catalyst for the increasingly active use of smartphones as a universal payment instrument, which allows simultaneously to "bind" several payment cards and choose for a specific payment the most suitable, taking into account loyalty programs, cash-runs or promotional offers.

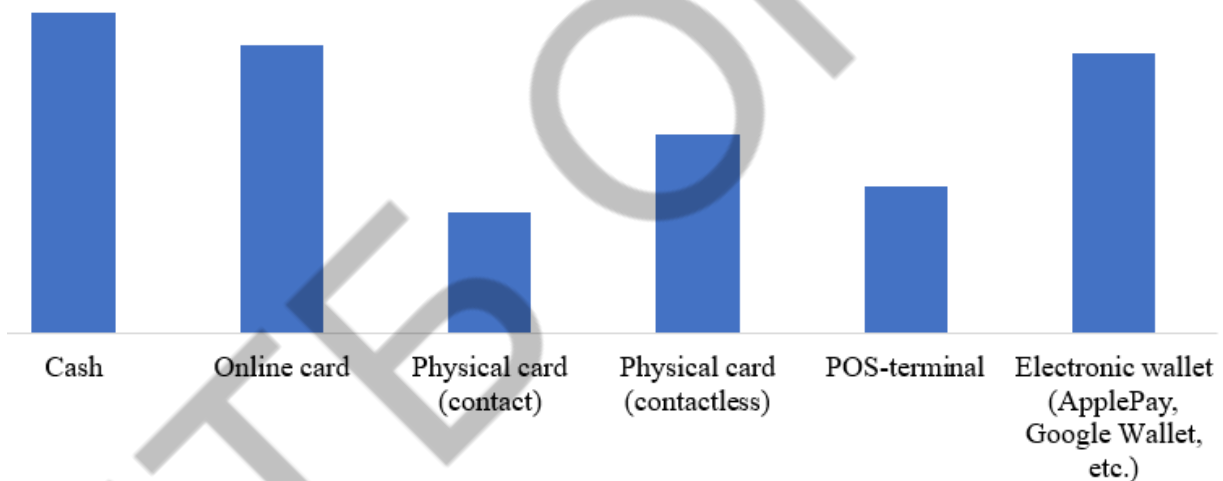


Fig. 9. Statistics of the most used payment methods during the last month.

Source: Based on the research conducted by the authors.

As previously mentioned, the main advantages of the contactless payment method are speed, convenience, and safety. In our research (Fig. 10) 96,6% of respondents emphasized convenience and 89,1% time savings.

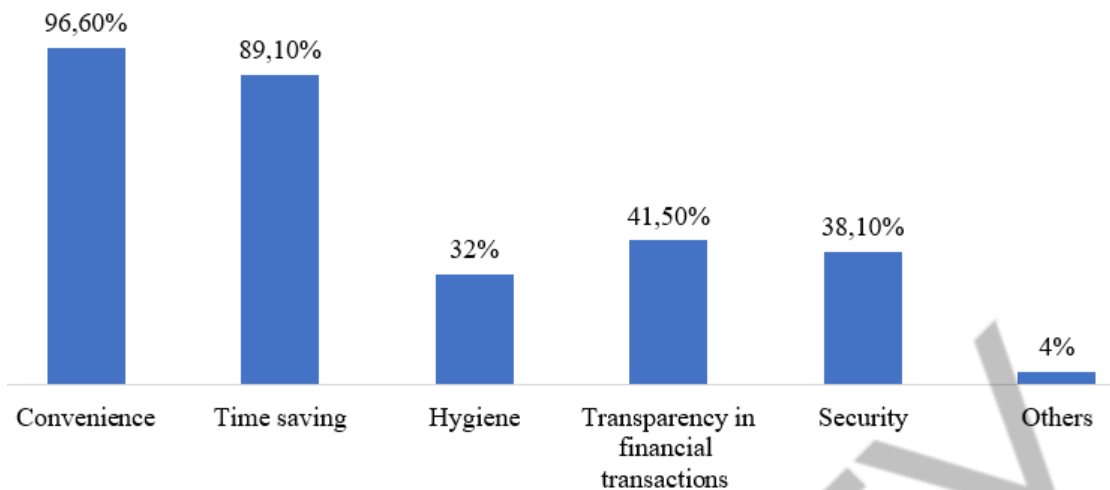


Fig. 10. Results of the survey on the advantages of using contactless payment methods.

Source: Based on the research conducted by the authors.

Taking into account the results of a survey on the main obstacles to the use of contactless payment methods (Fig. 11.), one can conclude that one of the main obstacles to the application of contactless payment methods is the absence of payment terminals with the possibility of contactless payment.

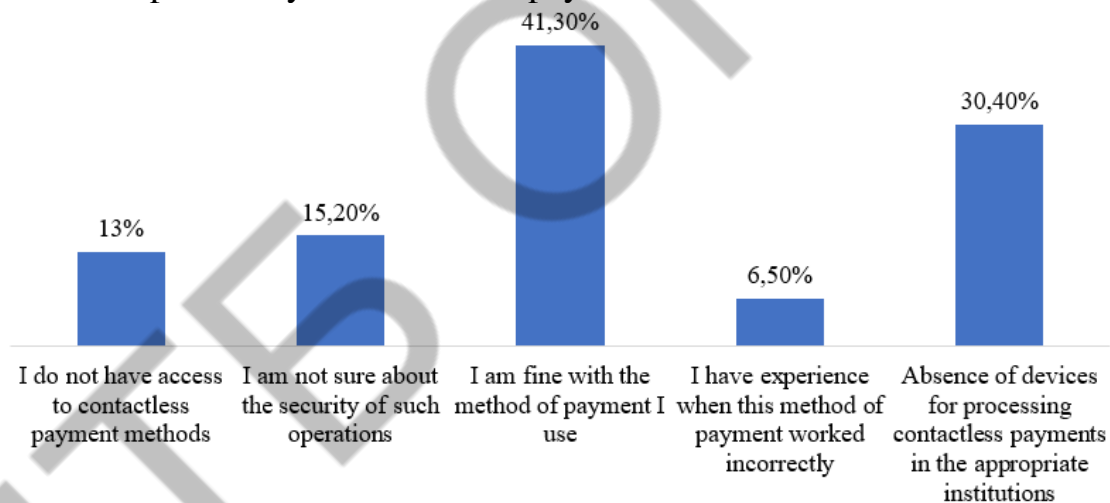


Fig. 11. Results of the survey on the main obstacles to the use of contactless payment methods

Source: Based on the research conducted by the authors.

Thus, analyzing the general situation of integration of contactless payments into the Ukrainian economy, we can say that in 2022 digital payments received special value. Contactless payment became a timely and convenient alternative during the COVID-19 pandemic when cash usage could threaten health. That is why it is not surprising that this year Ukrainians started to use cashless payment by 18% more often, namely contactless payments increased by 51%.

With the help of online payments, Ukrainians became closer to international commercial sites: Amazon, eBay, and AliExpress. If before making purchases on the world markets could only large businesses, now it is possible to buy goods not only in retail but also in wholesale (big order) can any user of the Internet. For example, many

start-up businessmen are bought at AliExpress, and then sell goods in retail through their private points or Internet sites.

Thus, new payment technologies improve life in Ukraine for both simple buyers and businesses. This opens up new investment and development opportunities for the country as a whole and every citizen in particular.

## V. CONCLUSIONS

Having conducted this research we have received the following result:

The work of modern scientists played a significant role in our research. In domestic and foreign works there is quite a clear idea about contactless payments. In particular, it is observed in the works of such scientists as L. P Bondarenko, N. B. Yaroshevich, A. B. Tarabinovich, O. Gough, R. Boon, J. LIM, Z. Dubinsky, D. Clark, A. Jeffries, A. Villarreal.

Summing up the analysis of the development of a non-contact payment method in the world, it is possible to note that this process is gaining momentum of rapid growth. The COVID-19 pandemic has had a significant impact on the choice of payment method, which has led users whom previously preferred contact payment methods to move to contactless.

If we talk about the situation in Ukraine, we can emphasize that our country has had significant success in the process of the settlement process. Thus, in 2019 it was included in the top ten largest supporters of contactless payments. The results of our research have shown that people are actively moving to the newest payment methods, arguing with the convenience, speed, and transparency of the process. The obstacle to the more active development of the contactless payment segment, as well as non-cash settlements in general, is still insufficient development of payment infrastructure: According to Mastercard, more than 60% of small and medium-sized businesses in Ukraine work exclusively with cash, simply not giving clients an alternative. It is also not a secret that some traders are only requesting to provide POS terminals with outlets de jure, and the terminal can be in the status of "not working", "repair" or "frozen" for weeks. The economy, which is alive due to the distortion of the volumes of real turnover and tax evasion – is the main opponent of the widespread introduction of non-cash payments.

In this way it is possible to form the main directions of the solution to the problem of digitalization of the banking system of Ukraine:

1. Ensuring the development of payment infrastructure - the network of acceptance of contactless payments should develop, as the market of Ukraine is not far oversaturated with payment terminals. Especially their lack is felt in small cities. Therefore, society should make every effort to provide the maximum possible number of institutions providing various types of services by payment terminals.

2. Not less important factor is an increase in financial literacy of the population to inform not only about the possibility of using contactless bank cards and NFC technologies but also about the advantages of contactless payments, in particular financial.

3. A rather effective way to solve the above problems is also the stimulation or encouragement of contactless settlements using the introduction of certain restrictions on cash settlements, the additional issue of token cards, and the introduction of new functional possibilities for contactless settlements with the use of cards or NFC technologies.

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