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The Ukrainian pension system of the future: The potential for using cryptocurrency instruments within pension provision

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Abstract. The relevance of the study is determined by the simultaneous deepening of demographic imbalances in the Ukrainian pension system and the active digitalisation of global financial markets, which makes the search for new investment instruments for the cumulative pension level urgent. The aim of the article was to justify the feasibility and conditions for integrating cryptocurrency instruments into Ukraine's mandatory cumulative pension system, taking into account international experience and national institutional constraints. To achieve this aim, methods of analysis and synthesis, comparative analysis, scenario and structural modelling, as well as generalisation of international practice in regulating digital assets were used. The main advantages and risks of using cryptocurrencies in long-term pension strategies are substantiated. The advantages included increased diversification opportunities, potential for growth in returns, and access to innovative financial assets. At the same time, key risks associated with high cryptocurrency market volatility, regulatory uncertainty, cybersecurity threats, and insufficient financial literacy among the population have been identified. An institutional and legal model for the phased introduction of cryptocurrencies into Ukraine's cumulative pension system has been proposed, which provides for the regulatory consolidation of the status of crypto assets, limiting their share in pension portfolios to 5-10%, the use of exclusively regulated instruments (exchange-traded funds, trusts), regular stress testing, training of non-state pension fund specialists, improving the financial literacy of the population, and implementing pilot projects with the participation of state institutions. The results of the study can be used in shaping state policy on the development of funded pension provision, as well as in improving the investment strategies of non-state pension funds in the context of the digital transformation of the economy

Keywords: funded pension provision; investment diversification; risk management; digitalisation; investment strategy

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Introduction

The effectiveness of the pension system is a key factor in the socio-economic stability of the state, especially in the context of an ageing population and the growing financial burden on solidarity-based pension mechanisms. In Ukraine, this problem is exacerbated by the decline in the working population, the budget deficit of the Pension Fund, and the delayed introduction of a mandatory accumulation level. Against this backdrop, the digitalisation of financial markets and the emergence of new asset classes are fuelling scientific debate on the possibility of using innovative instruments in pension investment strategies.

The problems of transforming Ukraine's pension system in conditions of long-term socio-economic instability are discussed in detail in the works of Ukrainian scientists. Thus, I.A. Nechaeva (2020) concluded that the current pension insurance model does not provide a sufficient level of social security and requires a structural overhaul involving accumulation mechanisms. A similar position is held by T.O. Staverska & I.L. Shevchuk (2017), who justified the need to diversify the sources of pension payments and increase the role of investment income in the context of the limited capabilities of the solidarity system. At the same time, these studies focus primarily on the institutional aspects of pension reform, without considering digital assets as a potential investmednt tool.

The use of cryptocurrencies and related financial instruments in portfolio investment has been actively researched in international scientific literature. Thus, A. Petukhina *et al.* (2021) noted that cryptocurrencies can serve as a portfolio diversifier due to their low correlation with traditional financial assets, but their inclusion is accompanied by increased volatility risks. Similar conclusions were reached by M. Soland & P. Schueffel (2021), who emphasised that cryptocurrencies can be acceptable in pension fund portfolios only if their share is strictly limited and subject to a high level of regulatory control. Aspects of financial stability and systemic risks of pension investments were considered in a study by S. Agrawal *et al.* (2025), which focused on the potential impact of non-traditional assets on the long-term sustainability of pension funds. The authors cautioned that excessive use of highly volatile instruments could create additional risks for future pension payments. In this context, the results of studies on the institutional adaptation of pension systems to digital technologies are important.

The practical aspects of integrating cryptocurrencies into the activities of pension funds are discussed in publications by international financial analytical resources. According to Pension Policy International (2024), some US pension funds have begun to invest in cryptocurrency assets through regulated exchange-traded funds, indicating the gradual institutionalisation of digital assets. Similar trends are observed in other countries, particularly in the United Kingdom and South Korea, confirming the global nature of this process (Financial Times, 2025). First, cryptocurrencies demonstrate the potential for portfolio diversification due to their low correlation with traditional assets. For example, E. Platanakis & A. Urquhart (2020) showed that Bitcoin, Ethereum and other crypto assets acted as diversifiers for European stock indices during the COVID-19 crisis, while some stablecoins even had hedge properties similar to gold. Second, they are capable of providing higher expected returns in the long term, which is important for accumulation systems. Thirdly, there are already successful practices in the world where cryptocurrency Exchange-Traded Funds (ETFs) are included in the investment portfolios of large pension funds, primarily in the United States, the United Kingdom, Japan, and Germany. For example, D. Krause (2025b) analysed real cases where US university endowments and pension funds began to choose Bitcoin ETFs as part of their long-term portfolios, demonstrating real ways to integrate crypto assets into conservative investment strategies. At the same time, cryptocurrencies remain high-risk assets due to their volatility, regulatory uncertainty, potential cyber threats, and technical difficulties in storage. For pension systems, where the main goal is capital preservation and payment stability, these risks are of fundamental importance. That is why it is necessary to critically assess the possibility and admissibility of using digital assets in the context of Ukrainian reform.

Cryptocurrencies can increase the diversification properties of portfolios, but their feasibility depends on the regulatory environment, the competence of administrators, the availability of licensing infrastructure, and the level of financial literacy among the population. In particular, D.G. Baur *et al.* (2018) found that Bitcoin has a low correlation with traditional financial assets but cannot be considered a full-fledged "safe haven" in periods of financial instability. S. Corbet *et al.* (2019) concluded that including cryptocurrencies in a portfolio can improve the risk-return ratio while increasing the overall volatility of assets. In turn, E. Bouri *et al.* (2021) emphasised that the use of crypto assets by institutional investors is only advisable in a developed regulatory environment, with licensed infrastructure and a high level of financial literacy among market participants. For pension systems focused on capital preservation and payment stability, these restrictions are of fundamental importance, which highlights the need for a critical assessment of the possibilities for integrating digital assets in the context of Ukrainian pension reform.

In Ukraine, research in this area is fragmented, and Law of Ukraine No. 2074-IX (2021) has not been fully implemented, creating a gap between the economic potential of innovations and the possibility of their practical implementation. In view of this, there is a need for a comprehensive analysis of whether cryptocurrencies can be integrated into the Ukrainian funded pension system, in what form, under what conditions and with what restrictions. International experience, which demonstrates a wide range of approaches – from cautious investments to models of direct ownership of digital assets – is of particular value to Ukraine. Thus, the aim of this study was to fill the existing scientific gap and justify possible ways of introducing cryptocurrencies

into pension investment portfolios, taking into account the peculiarities of the Ukrainian financial market.

Materials and Methods

The methodological framework of the study consisted of a set of theoretical and empirical methods that provided a comprehensive analysis of the possibility of using cryptocurrencies in funded pension systems. Statistical analysis was used to assess the dynamics of pension indicators in Ukraine and the financial characteristics of cryptocurrencies. The number of pensioners and the employed population for 2021-2025 was analysed, as well as the structure of pension payments based on data from the Pension Fund of Ukraine (2025). An analysis of the regulatory framework (Parliament of Ukraine, 2023) was used to identify the current regulatory conditions for the functioning of the pension system and the virtual asset market in Ukraine. Within the framework of this method, the provisions of national legislation in the field of pension provision were analysed, as well as regulatory acts governing the circulation of digital assets, in particular legislative initiatives on virtual assets. The advantages and risks of investing in cryptocurrencies were studied based on the work of A. Petukhina *et al.* (2021).

The next stage of the study was an analysis of the legal status of cryptocurrencies in countries where they are already included in pension portfolios. A comparative analysis of international experience was used to identify possible models for integrating cryptocurrency instruments into pension portfolios. To this end, countries with different levels of development of pension systems and financial markets were selected – the United States, the United Kingdom, Germany, Japan and South Korea. The criteria for selecting countries were: the existence of funded pension systems, the use of ETFs or similar instruments, and regulatory certainty regarding crypto assets (OECD, 2024; Kovács *et al.*, 2024; Krause, 2025a; 2025b). The study also used elements of socio-economic analysis to assess the impact of the population's level of financial literacy on the perception of digital assets as a potential tool for pension savings, based on the work of R. Munson (2022).

Scenario analysis was used to assess the potential consequences of using cryptocurrency instruments in Ukraine's funded pension system under various regulatory and market development conditions. Two generalised scenarios were developed within the study: conservative and moderately innovative. The main assumptions of scenario modelling were: maintaining the solidarity level of pension provision as the baseline; no direct ownership of cryptocurrency tokens by pension funds; use of exclusively licensed and regulated investment instruments; stability of macroeconomic conditions in the medium term. The input data for the scenario analysis were statistical indicators of the profitability and volatility of Bitcoin and Ethereum cryptocurrencies, data on the average profitability of traditional financial instruments, as well as indicators of pension payments and the demographic structure of the population of Ukraine. The expected returns, risks, and systemic stability of each scenario were compared. The criteria for comparing the scenarios were determined as follows: expected returns on pension assets, level of investment risk, impact on the financial stability of pension funds, and compliance with current and projected regulatory restrictions.

To assess the impact of financial literacy and age characteristics on the perception of digital assets as a pension investment tool, a secondary analysis of empirical data was used. The study is based on a summary of the results of international analytical and scientific publications containing statistical data on the participation of different age groups of the population in investing in cryptocurrencies. The analysis uses descriptive statistics and a comparative demographic approach, dividing respondents into age cohorts (25-34, 35-44, 45-54, 55-64, 65+ years). The criteria for comparison were the proportion of people who have experience investing in cryptocurrencies, as well as their level of willingness to take investment risks. The results obtained made it possible to identify a relationship between age, financial literacy, and the propensity to use digital assets in long-term financial strategies, particularly pension strategies.

Results

In the area of social insurance, particularly pensions, there are significant structural challenges due to increased life expectancy and an ageing population, which is putting more financial pressure on the pay-as-you-go pension system. In response to these demographic trends, many countries are implementing measures such as raising the average retirement age, encouraging private pension savings and restricting access to funds until retirement age is reached. At the same time, these instruments have a limited compensatory effect in the short and medium term and do not ensure a complete balance of the pension system through traditional sources of funding. Under these conditions, there is a pressing need to develop the funded level of pension provision and to seek long-term investment instruments capable of increasing the efficiency of pension asset formation. In this context, cryptocurrency instruments can be considered as a potential element of pension portfolio diversification, provided that there is adequate regulatory control.

As of 1 January 2025, there were 10,343,630 pensioners in Ukraine, which is 172,907 fewer than in 2024. Of these, 2.8 million continued to work, receiving an average of 6,302.76 UAH per month. The average pension as of 1 April of the same year was UAH 6,341.11. The dynamics of changes in the size of pensions for 2021-2025 are shown in Table 1.

Table 1. Dynamics of the average pension amount in Ukraine, 2021-2025

Year	Average pension amount, UAH
2021	3,507.50
2022	3,991.50

Table 1, Continued

Year	Average pension amount, UAH
2023	4,662.60
2024	5,385.25
2025 (1 January)	5,789.05
2025 (1 April)	6,341.11

Source: Pension Fund of Ukraine (2025)

Data analysis showed a steady upward trend in the average pension amount in Ukraine during 2021-2025. Over the period under review, the average pension payment almost doubled, due to both annual indexation and a review of social standards. At the same time, even the recorded growth does not compensate for the impact of inflationary processes and the rising cost of living, which limits the real purchasing power of pensioners. This trend confirms the structural vulnerability of the solidarity pension system and justifies the need to find additional sources of long-term financing for pension payments, in particular through the development of the accumulation level and diversification of investment instruments. Table 2 showed a gradual decrease in the number of pensioners and workers in Ukraine, with the number of pensioners already exceeding the number of officially employed persons, which creates an additional burden on the solidarity pension system.

Table 2. Dynamics of the number of pensioners and workers in Ukraine for 2021-2025

Year	Number of pensioners	Number of workers
2021	11,100,000	10,400,000
2022	10,900,000	10,350,000
2023	10,600,000	10,200,000
2024	10,500,000	10,150,000
2025	10,343,630	10,100,000

Source: Pension Fund of Ukraine (2025)

The data presented indicates a steady trend towards a reduction in the number of pensioners in Ukraine against the backdrop of a slow but systematic decline in the working population. Between 2021 and 2025, the number of pensioners decreased by more than 750,000 people due to demographic changes, migration processes and the impact of military factors caused by Russia's aggression against Ukraine. At the same time, the number of workers is also showing a downward trend, which negatively affects the ratio between insurance contributors and pension recipients. This situation increases the financial burden on the solidarity pension system and confirms the relevance of developing accumulation mechanisms and diversifying sources of pension provision. The distribution of pensioners by the size of their pension payments clearly demonstrates the unevenness in their level of provision in Figure 1.

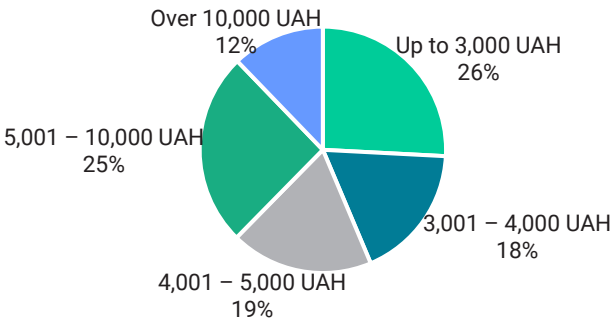

Figure 1. Distribution of pensioners by pension amount
Source: Pension Fund of Ukraine (2025)

The data in the figure show that a significant proportion of pensioners receive pensions that do not provide an adequate standard of living. According to research by D. Petrovskyy (2025), an acceptable level of income for most Ukrainians (31%) is between 20,000 and 30,000 hryvnia. This indicates that current pensions are significantly lower than the real needs of the population, which calls into question their ability to provide an adequate standard of living. Low pension payments and the limited purchasing power of pensioners point to the inefficiency of the current mechanisms for forming pension income. The absence of a cumulative component makes it impossible to use investment instruments to preserve and increase pension savings. In this regard, the integration of innovative financial instruments, in particular cryptocurrency products, into the cumulative system is seen as a potential direction for the modernisation of pension provision. In Ukraine, the creation of the Pension Fund was supposed to bring about a transition from state pension provision to compulsory pension insurance, but in fact this process has not been launched (Marchak *et al.*, 2016).

According to T.O. Staverska & I.L. Shevchuk (2017), Ukraine's pension system is undergoing reform aimed at ensuring a decent standard of living for citizens who have paid pension contributions throughout their working lives. The introduction of a second level of the pension insurance accumulation system was planned. This step was intended to ensure the financial stability of the pension system and increase the amount of pension payments to citizens, as well as eliminate disparities in the size of

pension payments. In this context, the Verkhovna Rada of Ukraine considered a number of initiatives, the implementation of which was postponed due to the full-scale invasion of Ukraine by the Russian Federation in February 2022. However, legislative work in this area continued: in particular, the law "On Mandatory Funded Pension Provision" (Parliament of Ukraine, 2019) is awaiting consideration, which provides for the phased introduction of a system of contributions amounting to 1% of salary with a gradual increase and redistribution of 5% of the Unified Social Contribution (USC). Draft law No. 9212 "On Funded Pension Provision" (registered on 17 April 2023 and returned for revision) provides for the mandatory participation of all insured persons who pay the USC in the mandatory funded pension system (Press Service of the Parliament of Ukraine, 2023). With regard to potential investment instruments, Ukrainian legislation establishes a list of permitted instruments for investing pension funds, including shares, bonds (government, municipal, corporate), deposits, gold and real estate. There are strict limits on asset allocation to minimise risks. For example, a fund can place up to 50% of pension funds in bank deposits, with no more than 10% in a single bank (Minfin, 2021).

In the context of modernising financial instruments for investing pension assets in Ukraine, the issue of legalising cryptocurrencies is becoming increasingly relevant. In the event of legislative regulation, non-state pension funds (NPFs) will be able to invest in virtual assets with a limit of 5% of total assets. This practice already exists in the United States, where ETF funds based on Bitcoin futures are traded (Minfin, 2024). However, Ukrainian institutional investors, particularly pension funds, are not ready to invest in cryptocurrencies due to the lack of proper regulatory framework and high level of risk. Pension strategies are usually based on a conservative approach, which is incompatible with the high volatility of the cryptocurrency market (Minfin, 2021). Thus, although the legalisation of cryptocurrencies may open up new opportunities for diversifying NPF assets, the issue of their practical use remains controversial and requires more in-depth analysis, taking into account the protection of the interests of future pensioners. The advantages and risks of investing in cryptocurrencies for the Ukrainian context are presented in Table 3.

Table 3. Advantages and risks of investing in cryptocurrencies

Advantages	Risks
Portfolio diversification (investing in cryptocurrencies can provide additional diversification of a pension fund's investment portfolio).	High volatility (cryptocurrency prices can fluctuate significantly, posing risks to the stability of pension savings).
High return potential (cryptocurrencies have the potential for significant growth in value, which can positively impact the return on pension savings).	Lack of regulation (insufficient legislative regulation of cryptocurrencies in Ukraine complicates their inclusion in the investment portfolio of pension funds).
	Security and storage (storing cryptocurrencies requires specialised solutions to ensure asset security).

Source: A. Petukhina *et al.* (2021)

The data presented in the table indicate that investment in cryptocurrencies combines both significant potential benefits and substantial risks, which is critically important in the context of pension provision. On the one hand, cryptocurrency assets are capable of enhancing the diversification of pension fund investment portfolios and providing an additional source of long-term returns. This is particularly relevant given the limited capabilities of traditional financial instruments and the growing burden on the solidarity pension system. On the other hand, the high volatility of cryptocurrencies, the lack of comprehensive regulatory and legal regulation in Ukraine, as well as increased requirements for the security and storage of digital assets create significant risks for the stability of pension savings. Thus, the results presented in the table confirm the advisability of using cryptocurrencies in pension investments exclusively as an auxiliary instrument with strict restrictions on their share in the portfolio and subject to the implementation of effective regulatory control.

In developed countries, the integration of cryptocurrencies into pension investments occurs mainly within the framework of regulated financial instruments. M. Soland & P. Schueffel (2021) noted in their work that in the United States, the use of cryptocurrencies in pension portfolios is carried out indirectly through exchange-traded funds (ETFs), which are supervised by financial regulators. In Japan, the government pension fund has initiated a study on the feasibility of using non-traditional assets in long-term investment strategies. In Germany, the BaFin regulator, within the European legal framework, allows the use of digital assets by specialised investment funds, which creates a legal basis for their potential inclusion in pension schemes.

The analysis of international experience in integrating cryptocurrencies into pension systems within the framework of this study was necessary for several key reasons that have both practical and strategic value for Ukraine: avoiding repetition of mistakes, adapting successful practices, and forming a realistic regulatory framework that takes into account modern approaches. In addition, international practice is an argument for the public and investors. According to the Financial Times (2025), in 2023-2025, there was a growing interest among pension funds in various countries in investing in cryptocurrencies. In this context, the results of a survey conducted by a Hungarian researcher among the Hungarian population on the understanding of the risks of cryptocurrencies and the willingness to delegate the management of such assets to pension platforms are indicative. The results obtained allow to assess the level of confidence in innovative investment decisions in funded pension systems and are summarised in Figure 2.

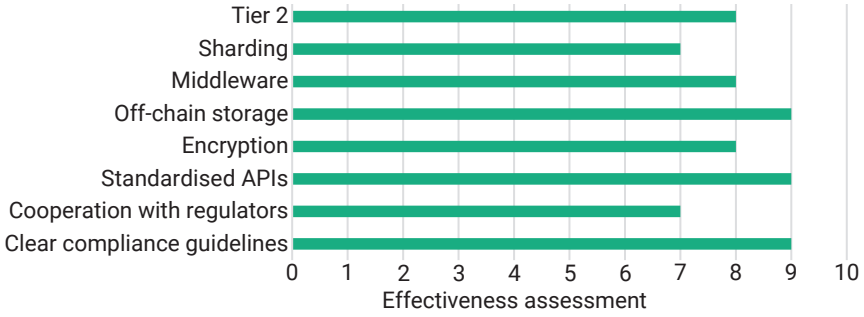

Figure 2. Level of trust among pensioners, administrators and IT specialists in Hungary in various blockchain-based pension system solutions

Source: D. Kovács *et al.* (2024)

The highest level of effectiveness (9) was given to factors such as clear compliance guidelines and standardised APIs. The following received a rating of 8: cooperation with regulators, encryption, off-chain storage, middleware solutions, and Layer 2 solutions. Sharding received the lowest rating (7). This indicates that trust depends most on the clarity of regulatory requirements and interaction standards, while technical aspects are less decisive. The United States is one of the first countries where pension funds began to study and, in some cases, implement cryptocurrencies as part of a long-term investment strategy. As of 2024-2025, there is no single approach to this issue in the United States – some funds choose cautious investment through exchange-traded funds (ETFs), while others, given the regulatory uncertainty, avoid crypto assets (Pension Policy International, 2024). In February 2024, it became known that the Wisconsin State Pension Fund had invested approximately $99 million in iShares Bitcoin Trust (an ETF created by BlackRock). This is one of the first examples of official participation by a state pension fund in a cryptocurrency ETF. The investment was made cautiously – through a regulated instrument that provides access to Bitcoin without directly purchasing tokens (Pension Policy International, 2024). Similarly, the Jersey City Pension Board approved a pilot investment in a Bitcoin ETF, arguing that it was necessary to modernise assets and take into account new market trends in the interests of insured persons.

Outside the United States, similar processes are observed in other developed countries. For example, in Germany, where the financial regulator (BaFin) has officially allowed digital assets to be included in the portfolios of specialised investment funds, including pension funds (Feng *et al.*, 2025). Such regulatory recognition lays the groundwork for the gradual adaptation of cryptocurrencies within institutional capital preservation schemes. In turn, South Korea's National Pension Service has acquired a significant stake in the cryptocurrency platform Coinbase, which can be seen as a preparatory step towards deeper participation in the digital economy (Rodrigues, 2025).

In the current context of financial market transformation, particularly as a result of the introduction of digital assets, corporate pension programmes are beginning to view cryptocurrencies as a potential tool for diversifying and increasing the profitability of investment portfolios. For example, the British company Cartwright has announced the creation of a pension payment scheme that allows employers to make contributions directly to employees' Bitcoin wallets. This initiative aims to reduce dependence on employer contributions and gives employees the opportunity to receive pension payments in cryptocurrency (Cartwright Pension Trusts, n.d.). Under this programme, 3% of the pension portfolio was invested directly in Bitcoin, rather than through derivatives or exchange-traded funds (ETFs). This approach is unique in European practice, as it involves direct ownership of digital assets, with all the associated issues of security, storage and regulatory control. It is important to note that the investment decision was made after a comprehensive due diligence process. Using the example of the Hungarian pension system, the effectiveness of implementing blockchain technologies in the pension system was assessed according to various criteria (Fig. 3).

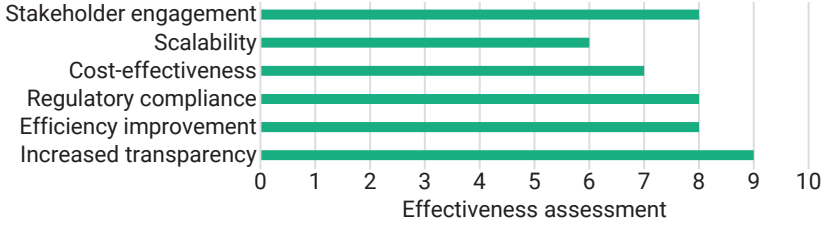

Figure 3. Level of implementation of blockchain solutions in Hungary's state pension systems

Source: D. Kovács *et al.* (2024)

Transparency received the highest rating (Enhanced Transparency – 9 points), followed by stakeholder engagement, efficiency and regulatory compliance (8 points each). The lowest scores were given to scalability (6 points) and cost-effectiveness (7 points). This indicates that the main value of blockchain for pension systems is increased transparency, while scalability and costs remain key challenges. In the process of integrating cryptocurrencies into pension programmes, the role of financial regulators is fundamental, as they form the legal basis, define the institutional framework for investment and ensure a balance between the innovation of financial instruments and the protection of the interests of system participants. The following areas of regulatory activity should be highlighted (Kovács *et al*., 2024):

- providing a regulatory definition of the status of cryptocurrencies (regulators determine whether digital assets are considered permissible instruments for pension investments);
- ensure "fiduciary responsibility" (supervising funds to ensure they act in the interests of insured persons);
- license infrastructure (regulating exchanges and brokers and ensuring compliance with security procedures);
- monitor systemic risks (assess the potential impact of cryptocurrencies on the financial stability of the pension system and the economy as a whole).

Regulators act not only as arbitrators but also as facilitators of innovation in the pension system. Their strategy determines the speed, depth and safety of the introduction of cryptocurrencies into institutional portfolios. Although the full-scale integration of cryptocurrencies into pension systems has not yet taken place, some developed countries are in the phase of active testing, regulatory definition and strategic planning on this issue. The variety of approaches – from cautious ETF investments to exploring direct participation models – reflects a global trend towards seeking new sources of returns amid heightened financial instability and a paradigm shift in long-term savings.

The introduction of a funded pension system in Ukraine opens a new phase in the transformation of the pension system (OECD, 2024). In this context, the question arises as to the admissibility and expediency of including non-traditional assets – in particular cryptocurrencies – in the investment portfolio of pension savings. This issue is particularly relevant given the need to ensure high returns, long-term stability and protection against inflationary risks.

On the one hand, Ukraine is seeing positive developments in the recognition and regulation of digital assets. In 2021, the Verkhovna Rada adopted Law of Ukraine No. 2074-IX (2021), which was supposed to become the basis for legalising the cryptocurrency market. However, as of 2025, this law has not entered into force, as the accompanying amendments to the Tax Code have not been adopted and a comprehensive regulatory and legal infrastructure has not been created. Accordingly, the cryptocurrency market in Ukraine remains partially regulated and operates in conditions of legal uncertainty, which creates serious barriers to the participation of pension funds or other institutional investors, as noted by V. Forsiuk (2024).

In practice, the integration of cryptocurrencies into the pension system requires systematic regulatory, technological and regulatory preparation. First, the relevant state authorities must clearly define the role and status of cryptocurrencies as an investment object within pension assets. Separate provisions are needed in the subordinate acts of the National Securities and Stock Market Commission (NSSMC) regarding eligible assets for accumulative pension funds, taking into account the level of risk, volatility and reliability criteria of counterparties. However, given the cross-sectoral nature of cryptocurrencies, which simultaneously covers financial markets, payment systems, tax policy and investment regulation, there is a need for enhanced coordination between several regulators. In particular, the NSSMC, the National Bank of Ukraine (NBU) and the Ministry of Finance should jointly develop a coordinated regulatory framework that would ensure a balance between the innovation of digital assets and the protection of the rights of insured persons. Secondly, the rights of system participants should be protected by setting limits on the share of high-risk assets in the overall portfolio, for example, no more than 5-10%. In this context, two regulatory scenarios were proposed as examples, with limits on the share of cryptocurrencies in the pension portfolio (5% and 10%) and an assessment of their impact on the stability of the system, taking into account the relationship between expected returns and volatility, as well as international experience and regulatory requirements (Table 4).

Table 4. Comparative analysis of regulatory scenarios with limits on the share of cryptocurrencies in the pension portfolio

Parameter	5% limit	10% limit
Expected return	Moderate growth (≈5.5%)	Higher growth (≈6.2%)
Portfolio volatility	Lower risk (≈16%)	Lower risk (≈16%)
Systemic stability	Higher, controlled risks	Lower, increased risks
Participant protection	Better, loss limitation	Weaker, higher probability of losses
Compliance with standards	Consistent with conservative approaches	Corresponds to innovative approaches

Source: compiled by the authors based on M. Soland & P. Schueffel (2021), S. Agrawal *et al.* (2025)

A 5% limit on cryptocurrencies allows for increased portfolio returns without a significant increase in volatility. This is in line with the conservative strategy used by most pension funds around the world and ensures greater

stability of the system and protection of participants' interests. This approach is recommended for the initial stage of crypto asset integration. Increasing the limit to 10% allows for even higher expected returns, but the risks of volatility increase disproportionately. This can lead to significant fluctuations in the value of the portfolio, which is critical for a pension system where capital preservation and predictability of payments are priorities. Such a scenario is only feasible if there is a developed infrastructure, high financial literacy and effective regulatory oversight. Thus, a lower limit (5%) better protects the pension system from systemic risks, maintaining a balance between return and safety; a higher limit (10%) can only be justified after positive experience has been accumulated.

The determination of the share of cryptocurrency in the pension portfolio should be based on a number of key considerations. In particular, it is advisable to introduce strict restrictions on the share of cryptocurrency assets at a minimum level with the possibility of their gradual increase only based on the results of systematic risk monitoring and assessment of the stability of the pension system. It is also important to use only regulated financial instruments, such as exchange-traded funds (ETFs) or investment trusts, to minimise operational and legal risks. In addition, a necessary element of risk management is regular stress testing of pension portfolios to assess the impact of high volatility of cryptocurrency assets on the overall financial stability of the pension system.

It is critically important for the effective functioning of the accumulation model to take into account the level of financial literacy of the population. Investing in digital assets requires a basic understanding of the risks, the principles of blockchain infrastructure, and knowledge of the rules for using digital wallets and exchanges. In the absence of a systematic educational policy in the field of financial education, investor behaviour can be overly risky, creating additional challenges for the stability of the pension system. An analysis of the perception of digital assets as a pension instrument leads to the conclusion that the level of investment in cryptocurrencies varies significantly depending on age group, as shown in Figure 4.

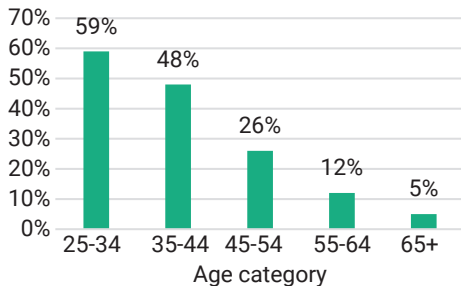

Figure 4. Percentage of those who invest in cryptocurrencies, by age group
Source: R. Munson (2022)

The youngest generation is the most active: 59% of people aged 25-34 and 48% in the 35-44 age group have experience investing in cryptocurrency. In the 45-54 age group, the share of investors decreases to 26%, and among people aged 55-64, to 12%. The lowest level of participation is recorded among people aged 65 and older – only 5%. The results show that investing in digital assets is mainly carried out by the younger population, which demonstrates greater awareness of digital technologies and greater willingness to take risks associated with the volatility of the cryptocurrency market.

Another critical prerequisite is the existence of a regulated infrastructure: licensed exchanges, custodial services, and independent auditing of digital assets. Without clear procedures for storage, transaction verification, and monitoring of intermediaries, the risks of abuse or loss of funds will remain extremely high. In this regard, the experience of the US and the EU in allowing only regulated exchange-traded products, such as spot ETFs or cryptocurrency trusts, into pension portfolios may be most relevant for Ukraine. An additional challenge is ensuring cybersecurity and training specialists capable of administering cryptocurrency assets within pension funds.

Given the current state of the Ukrainian financial market, a mixed model could be a reasonable approach: introducing the possibility of investing in cryptocurrency derivatives (e.g. through international ETFs) (Krause, 2025a; 2025b) that meet European transparency standards, and then, once a reliable infrastructure is in place, gradually move towards partial direct investment. In the long term, if all conditions are met – in particular, technical modernisation, the creation of a guarantee fund and the strengthening of regulatory oversight – the inclusion of digital assets in pension portfolios could serve not only as a source of additional income for insured persons, but also as an incentive for further financial inclusion and the development of the Ukrainian stock market. This study proposes a mechanism for investing pension savings in cryptocurrencies in Ukraine. These proposals constitute an institutional and legal model for the phased introduction of cryptocurrencies into the Ukrainian pension system. This model combines global experience (the United States, the United Kingdom, South Korea), risk assessment (volatility, lack of regulation, security) and consideration of the specifics of the Ukrainian market (low level of financial literacy and legal uncertainty). This mechanism and its expected effects are systematised in Table 5. The proposed ways of investing in cryptocurrencies for the funded pension level in Ukraine reflect a comprehensive approach to the integration of cryptocurrency instruments into Ukraine's funded pension level, combining innovation with the principles of prudence and risk-oriented regulation. The proposed measures cover both investment aspects (use of ETFs, scenario modelling, phased implementation) and institutional conditions (development of a regulatory framework, training of administrators, interagency coordination). Particular emphasis is placed on minimising financial and legal risks by limiting

the share of crypto assets in portfolios, creating guarantee mechanisms and introducing stress testing. Another important component is improving the financial literacy of participants in the accumulation system, which will help build trust in new investment instruments. The implementation of these proposals will allow Ukraine's pension system to gradually adapt to digital financial transformations without threatening the stability of pension payments.

Table 5. Proposed ways of investing in cryptocurrencies for the cumulative pension level in Ukraine

No.	Proposal	Expected effect/justification
1	Introduction of a cap on cryptocurrency assets in the portfolios of non-state pension funds (NPFs)	Minimisation of risks while preserving the benefits of diversification
2	Investment exclusively in regulated instruments (cryptocurrency ETFs and trusts)	Ensuring transparency, accountability and compliance with international standards
3	Gradual implementation of scenario modelling (stress testing) of pension portfolios	Identification of portfolio sensitivity to crypto market volatility
4	Establishment of a regulatory framework at the level of the National Securities and Stock Market Commission, with a clear definition of cryptocurrencies as an asset class	Prevention of legal gaps and safeguarding the rights of insured persons
5	A phased implementation model: from ETFs to partial direct ownership of cryptocurrencies	Ensuring system adaptation to new instruments and gradual accumulation of practical experience
6	Introduction of specialised training for NPF administrators in digital assets	Enhancement of the efficiency of cryptocurrency instrument management
7	Financial education for future pensioners (particularly individuals aged 25-45)	Strengthening trust in the funded pension system and promoting informed investment behaviour
8	Pilot NPF project with state support based on ETFs and transparent performance monitoring	Establishing a precedent, assessing effectiveness in practice, and promoting the model under real-world conditions
9	Creation of a guarantee insurance reserve in the event of a crypto market collapse	Protection against catastrophic losses in unstable market conditions
10	Multi-agency regulation: coordination between the National Securities and Stock Market Commission, the National Bank of Ukraine, and the Ministry of Finance	Ensuring the integrity of the regulatory environment and policy coherence

Source: developed by the authors

Discussion

The results obtained in this study are generally consistent with the conclusions of contemporary scientific works devoted to the use of cryptocurrencies and related instruments in long-term investment strategies, but at the same time have a number of differences due to the focus on pension systems and, in particular, on Ukrainian institutional realities. Unlike most publications, which view cryptocurrencies primarily as a speculative or portfolio asset, this study analyses them through the prism of financial stability and the protection of the interests of future pensioners. The results of the study confirm that the Ukrainian pension system is undergoing structural transformation and needs to integrate a funded level to ensure financial stability and increase pension payments. Although the growth in the average pension amount in 2021-2025 showed positive dynamics, it does not compensate for the impact of inflation and the rising cost of living, which highlights the structural vulnerability of the solidarity level of pension provision.

Thus, the results of this study correlate with the conclusions of K.O. Rudolf *et al.* (2021), who, based on Dynamic Conditional Correlation Multivariate GARCH modelling, proved that Bitcoin is characterised by high volatility and unstable hedging properties. Similar to their results, this study found that the use of cryptocurrencies in pension portfolios is only possible under strict restrictions on the share of such assets and the application of additional protective risk management mechanisms. At the same time, unlike the approach of the aforementioned authors, which focuses primarily on financial and mathematical analysis, this study additionally takes into account the institutional and regulatory constraints of pension systems.

A comprehensive review by D. Kang *et al.* (2025) showed that cryptocurrencies are increasingly being viewed as a separate class of financial assets with their own patterns of return and risk. The results of this study confirmed this approach, particularly in terms of the low correlation of cryptocurrencies with traditional assets, which enhances their diversification potential. At the same time, this study emphasised that it is not only the statistical effectiveness of diversification that is important for pension systems, but also the compliance of crypto instruments with the principles of stability and predictability of payments. The issue of the admissibility of using crypto assets in pension investments was examined in detail by J.A. Turner (2025), who emphasised the need for a clear regulatory distinction between direct ownership of cryptocurrencies and investment through regulated instruments. The results obtained in this article are fully consistent with this approach: scenario analysis has shown that the most acceptable option for Ukraine is the indirect use of cryptocurrencies – through ETFs or other licensed products, rather than direct ownership of tokens by pension funds. A separate aspect of the long-term use of crypto assets in pension investments is

related to the issue of macrofinancial stability and systemic risks. Thus, G. Okechukwu (2024) emphasised that despite the diversification potential of cryptocurrencies, their behaviour during periods of financial shocks remains unstable, which may increase risks for institutional investors. The results obtained in this study are consistent with this conclusion, as scenario analysis has shown the increased sensitivity of pension portfolios to crypto assets in crisis conditions, which necessitates the use of conservative restrictions and constant macroprudential monitoring.

Empirical studies by D. Krause (2025a; 2025b), devoted to the analysis of US pension fund and endowment portfolios, have shown that the real integration of Bitcoin ETFs is already taking place within limited asset shares. A similar conclusion is reached in this study: a moderately innovative scenario, which assumes investments at the level of 3-5% of the portfolio, proved to be the most balanced in terms of the ratio of risk and expected return. The difference is that D. Krause focused primarily on the US market, while this article attempts to adapt these approaches to Ukrainian institutional conditions. The role of cryptocurrencies in the long-term portfolios of institutional investors is also discussed in a systematic review by J. Mosina & G. Ševčenko (2024), which emphasised that decisions on the inclusion of digital assets largely depend on regulatory certainty and the level of institutional maturity of the financial system. The conclusions of this study correlate with the results of this work, since for Ukraine, the key constraints on the integration of cryptocurrencies into pension investments remain the underdevelopment of the accumulation level and the limited regulatory framework. Institutional restrictions on the use of crypto assets are also related to issues of corporate governance and the responsibility of financial institutions. Thus, D. Yermack (2017) emphasised that blockchain technologies and related digital assets create new challenges for management systems, transparency and risk control in large institutional structures. The results obtained in this study are consistent with these conclusions, since not only profitability indicators remain critical for pension funds, but also the compliance of crypto instruments with the requirements of accountability, asset protection and trust of pension system participants.

The role of investor confidence and financial culture is explored in a study by Y. Baeckström *et al.* (2025), which showed that willingness to participate in the crypto market largely depends on the level of trust in financial institutions. The results obtained in this work confirmed the above conclusion: an analysis of age groups showed that older categories of the population demonstrate a significantly lower willingness to accept cryptocurrencies as an element of pension savings, which reinforces the importance of financial education programmes. Studies by Y. Ma *et al.* (2020) and D. Bianchi & M. Babiak (2022) complemented the results of this work in terms of portfolio optimisation and the effectiveness of cryptocurrency funds. While Y. Ma *et al.* emphasised the potential of digital assets within optimisation models, D. Bianchi & M. Babiak draw attention to the volatility of crypto fund returns across different market phases. This is consistent with the findings of this study on the need for cautious, phased introduction of cryptocurrencies into pension portfolios with constant monitoring of market risks.

Thus, the results of this article confirmed the global scientific consensus on the possibility of using cryptocurrencies as an auxiliary diversification tool, while expanding it by taking into account the regulatory, demographic, and institutional characteristics of the Ukrainian pension system. The conclusions complement existing research and form a practical basis for further scientific research and pilot projects in the field of funded pension provision. Overall, the study opens the door for further discussion on the optimal model for integrating innovative financial instruments into Ukraine's funded pension systems, taking into account national characteristics and international experience.

Conclusions

The study assessed the potential for using cryptocurrencies in Ukraine's pension accumulation system and identified the key advantages, risks and scenarios for integrating digital assets into pension portfolios. Among the main advantages of investing in cryptocurrencies was their ability to increase the diversification properties of portfolios due to their low correlation with traditional financial assets. In addition, digital assets have the potential to provide higher expected returns in the long term, which is important for the formation of cumulative pension assets. International experience showed that cryptocurrencies can be included in pension portfolios either through indirect instruments (ETFs, trusts) or through direct ownership of tokens, which allows the strategy to be adapted to the level of risk and regulatory certainty. Key risks associated with the integration of cryptocurrencies into pension systems have been identified. The most important ones were determined to be high asset volatility, the lack of adequate legislative regulation in Ukraine, cyber threats, and difficulties with secure storage. For pension systems focused on stable payments and capital preservation, these factors are critically important, necessitating a cautious approach to the use of digital assets.

The results of the scenario analysis indicated the advisability of limited integration of cryptocurrencies into pension portfolios. A conservative scenario with a 5% limit on the share of cryptocurrencies in the portfolio provides a moderate increase in expected returns with a controlled level of volatility and high protection for system participants. A moderately innovative scenario with a 10% limit allows for higher expected returns, but is accompanied by a disproportionate increase in risks and requires a developed regulatory infrastructure, a high level of financial literacy among the population, and regular stress testing of portfolios. The results confirmed that cryptocurrencies can be integrated into the Ukrainian funded pension system only under conditions of clear regulatory oversight, restrictions on the share of high-risk assets, the use of licensed instruments (ETFs, trusts), and effective control by financial regulators.

Possible promising areas for further research in this field are primarily related to assessing the impact of cryptocurrency assets on the long-term financial stability of pension funds under various macroeconomic development scenarios. Special attention should be paid to the development of methodological approaches to stress testing pension portfolios with the inclusion of highly volatile financial instruments, as well as research into models combining traditional and digital assets in order to optimise the ratio of expected return and investment risk. Another important area for further research would be to analyse the effectiveness of financial education programmes and information campaigns aimed at increasing the level of trust in digital assets among participants in the funded pension system. In addition, it is promising to study the mechanisms of interaction between regulatory authorities and pension funds in the process of introducing innovative financial instruments within the framework of current and future Ukrainian legislation. Thus, the study demonstrated that cryptocurrencies can become an additional tool for diversifying pension portfolios, provided that adequate regulatory control, technological security and a high level of financial competence of the system participants are ensured.

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Conflict of Interest

None.

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Українська пенсійна система майбутнього: потенціал використання криптовалютних інструментів у рамках пенсійного забезпечення

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Анотація. Актуальність дослідження зумовлена одночасним поглибленням демографічних дисбалансів у пенсійній системі України та активною цифровізацією світових фінансових ринків, що актуалізує пошук нових інвестиційних інструментів для накопичувального пенсійного рівня. Метою статті було обґрунтування доцільності та умов інтеграції криптовалютних інструментів до системи загальнообов'язкового накопичувального пенсійного забезпечення України з урахуванням міжнародного досвіду та національних інституційних обмежень. Для досягнення поставленої мети було застосовано методи аналізу й синтезу, порівняльного аналізу, сценарного та структурного моделювання, а також узагальнення міжнародної практики регулювання цифрових активів. Обґрунтовано основні переваги та ризики використання криптовалют у довгострокових пенсійних стратегіях. До переваг віднесено розширення можливостей диверсифікації, потенціал зростання дохідності та доступ до інноваційних фінансових активів. Водночас визначено ключові ризики, пов'язані з високою волатильністю крипторинку, регуляторною невизначеністю, загрозами кібербезпеки та недостатнім рівнем фінансової грамотності населення. Запропоновано інституційно-правову модель поетапного впровадження криптовалют до системи накопичувального пенсійного забезпечення України, яка передбачає нормативне закріплення статусу криптоактивів, обмеження їх частки у пенсійних портфелях на рівні 5-10 %, використання виключно регульованих інструментів (біржові інвестиційні фонди-ETF, трасти), проведення регулярного стрес-тестування, підготовку фахівців недержавних пенсійних фондів, підвищення фінансової грамотності населення та реалізацію пілотних проєктів за участю державних інституцій. Результати дослідження можуть бути використані у формуванні державної політики щодо розвитку накопичувального пенсійного забезпечення, а також під час удосконалення інвестиційних стратегій недержавних пенсійних фондів в умовах цифрової трансформації економіки

Ключові слова: накопичувальне пенсійне забезпечення; диверсифікація інвестицій; управління ризиками; цифровізація; інвестиційна стратегія