

The Possibilities of Artificial Intelligence in Pension Security

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Abstract: One of the most defining socio-economic challenges of the 21st century is the aging population and the sustainability of pension systems resulting from it. Artificial intelligence (AI) offers exciting opportunities, but its introduction must be handled carefully and responsibly. The aim of this study is to comprehensively present the new opportunities that AI offers in different areas of pension security, the risks that the technology poses, and the conditions that are necessary for AI to create real social value in this strategically important area. To this end, the paper reviews the current challenges facing pension systems, presents the most important AI technologies and their specific uses, and analyzes the economic and social impacts of their introduction. The study aims to contribute to the understanding of the role of AI in shaping the future of pension security and to provide a professional basis for further research and decision-making processes.

Keywords: pension security, artificial intelligence (AI), pension planning tools, cyber security, pension system resilience

1 Introduction

The world was shaken by three major explosions at the beginning of the 21st century: the population explosion, the longevity explosion and the information explosion [1]. The population explosion is a rapid, rapid increase in population, which usually occurs when the birth rate is high, while the death rate is falling. This phenomenon can still be observed in developing countries, but the world's population growth rate is slowing down. Longevity means that we not only live longer, but also do so healthily and actively, i.e. we do not only add years to life, but also add life to years. It also includes increasing life expectancy and healthy life expectancy, which aims to improve the quality of life. The deteriorating demographic situation is typical of the countries of the European Union, including our country. The information explosion refers to the explosive growth in the amount of information, which has accelerated in the digital era thanks to the development of technology, the Internet and social media. This phenomenon involves access to a vast amount of often unfiltered information, which poses challenges for people,

such as brain adaptation pressures, communication bottlenecks and intergenerational alienation. Global demographic changes, ageing societies and sustainability challenges of financial systems are putting increasing pressure on pension systems [2]. The emergence of artificial intelligence (AI) offers new opportunities to improve pension security, manage risks and support individual decision-making. The application of AI in this area is not only crucial for technological innovation, but also for social and economic stability [3].

2 The basics of pension security

Social security is one of the fundamental institutions of modern societies. The social security system consists of several subsystems, including pension insurance, health insurance, and the social welfare system [4]. The pension system is an institutional structure established according to specific principles, which ensures the livelihood of individuals who are unable to work due to old age (or disability) through regular financial support (pension benefits). Pension systems can be grouped, compared, or contrasted according to their systems, sources, and regulations. According to the European Commission's Green Paper (Towards adequate, sustainable and safe European pension systems) published in 2010 [5] and the 2012 White Paper (An Agenda for adequate, safe and sustainable European pensions) [6], the fundamental objective of pension systems is to provide adequate pension income, to help older people live in decent conditions and in economic independence, and to ensure that pensions play an automatic stabilising role.

The role of the pension system is to provide income security in old age or in the event of the death of a close relative. In the state pension system, entitlement to benefits is based on the payment of pension contributions. The state guarantees the payment of pensions and ensures that the real value of pension benefits is preserved [7]. According to the European Commission [8] Pension Adequacy Report, EU pension systems can only be expected to provide an adequate level of pensions for future generations if Member States implement sufficiently strong policy measures to ensure that as many workers as possible remain active until they reach the official pension age. Employment policies should offer more opportunities for older workers to stay in the labour market for longer. At the same time, pension systems should also protect those who cannot stay in the labour market long enough to build up sufficient pension rights [2].

The Organisation for Economic Co-operation and Development (OECD) is an international economic organisation based in Paris, of which Hungary has been a member since 1996. It is a global organisation whose aim is to help Member States' governments design and evaluate the best possible economic and social policies. According to the OECD [9] [10], pension systems generally consist of three pillars (Figure 1).

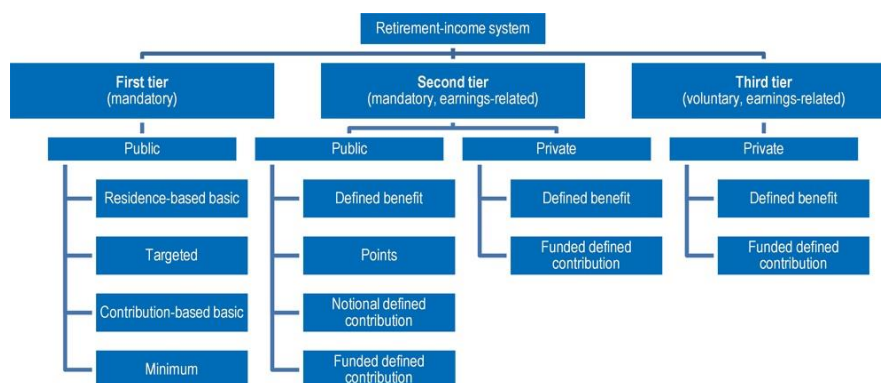


Figure 1
Summary framework of different pension financing systems
Source: Own compilation based on OECD [9] [10]

The “first pillar” (state) pensions are statutory state pensions managed by the state, usually financed from social security contributions and/or general tax revenues on a pay-as-you-go (PAYG) basis. In some countries, individual schemes financed by law have been introduced alongside the first pillar. The “second pillar” (employer) pensions are private supplementary schemes linked to employment. Finally, the “third pillar” (personal) pensions are personal pensions, i.e. pre-funded private voluntary supplementary schemes in which contributions are invested in an individual account held by a pension fund or financial institution.

The following is an overview of the factors determining individual pension security and the related decision options [11]. In his study *Pension Plans, Pension Funds and Pension Organizations*, he distinguishes between public and private pension schemes, as follows:

- Public pension schemes: social security and similar schemes where the public sector (i.e. central, state and local governments, including social security institutions) manages the payment of pension benefits. They aim to provide minimum (flat rate and/or earnings-related) benefits to the population as a whole (or at least the formal sector) upon pension. Public schemes are traditionally financed by PAYG, but some OECD countries partially pre-finance public pension obligations or have replaced these schemes with private pension funds.
- Private pension schemes: a pension scheme in which the payment of pension benefits is managed by an institution outside the public sector. Private pension schemes are managed by an employer, pension organisation or private sector service provider acting as the scheme sponsor. Private pension schemes can complement or replace social security schemes. In some countries, they may also include schemes for public sector employees. Private pension schemes are funded by OECD countries.

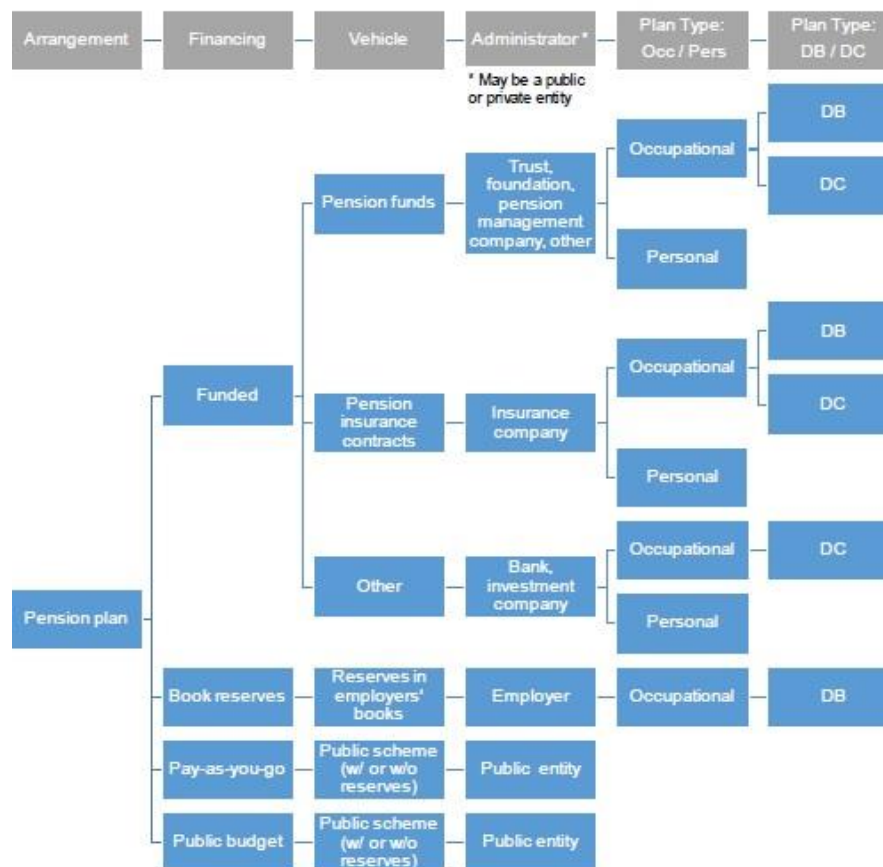


Figure 2

Features of pension plans

Source: Own compilation based on OECD [12] [13]

Regarding financial decisions related to pension at an individual level, only in the case of private pension programs (pension savings plans), state systems exclude the possibility of such individual decisions. In the following, it is worth defining what we mean by pension savings. In the broadest sense, pension savings can be understood as any long-term, voluntary or non-voluntary form of savings that is intended to serve the financial security of the later stages of life and that does not come from state old-age pensions (i.e. not from the first pension pillar). In this case, pension savings includes classic voluntary savings products such as voluntary pension funds and pension insurance, as well as private pension funds. But in a broad sense, it also includes life insurance, real estate investment and all country-specific – even preferentially taxed – forms of pension savings (pension bonds, special pension accounts, etc.).

The OECD uses the definition of pension savings plan [12] [13], 2022), which includes all financial instruments from which long-term payments are derived (Figure 2). These instruments can be in pension funds (pension fund), pension insurance contracts (pension insurance), or other forms of savings (pension savings account). Thus, private pension fund accounts, which can be interpreted as the second pillar, are also classified as forms of pension savings, especially given that their presence is not evident among pension products in the four countries examined (in Hungary and Poland, after the redirection of private pension fund contributions to the first pillar, the role of this form of pension savings became very low [14].

3 The AI opportunities in the pension system

Pension systems around the world are under demographic and financial pressure. Artificial intelligence (AI) – including machine learning (ML) and generative AI – offer promising tools to improve the coverage, efficiency, equity and resilience of schemes. According to a review by OECD [3], client support, automation of back-end processes and solutions to detect errors and fraud are already widely used in social protection. Predictive analytics and personalised interventions are the next major development directions. Pension industry-specific analyses show that AI can deliver measurable results across the entire value chain – from enrolment to payout – but require strong governance, transparency and member trust.

OECD governments are increasingly using advanced data and technology to improve the coverage, efficiency and effectiveness of social programmes, but they are also cautious about introducing artificial intelligence (AI). Common uses of AI in social protection include customer support, automation of back-office processes and fraud detection. Looking ahead, AI has significant potential to improve the performance of social programmes – including through predictive analytics, increased awareness and more tailored interventions – but governments need to continue to build trust and promote transparency in the use of AI.

The OECD outlines key opportunities and recommendations for the application of AI in pension systems, which are summarised in Table 1 with descriptions and pension-specific examples. The OECD recommends the application of AI in pension systems by implementing tools that support clients, make administration more efficient, improve fraud protection, cybersecurity, data protection, facilitate personalised interventions and expand access to services. It places this behind sound regulatory, governance and human capacity-building measures, in full accordance with the OECD “Trustworthy AI” principles [3].

Recommendation	Description	Pension-specific example
Human-centric, reliable AI	AI serves people, providing decision support; in particularly sensitive life situations (widowhood, orphanhood, disability), human supervision is mandatory.	Pre-screening for eligibility for care with AI, but final decision with an administrator; humane handling of individual equity cases.
Transparency and explainability	Communicating the role of AI; justifying decisions and displaying "reason codes".	Publishing factors behind eligibility scores; decision-support explanation on the client portal.
Data protection and security (GDPR)	Data minimization, access control, logging; risk management of the use of generative AI.	Pension dashboard: strong authentication, contribution management and logging; protection of sensitive documents.
Fairness and bias reduction	Incorporation of data cleaning, representativeness, bias tests and fairness audit.	When detecting payment anomalies, demographic parity analysis (age, gender, region).
Pilot → scaling	Learning from small pilots, gradual national expansion after measurable KPIs.	Pension chatbot pilot in one region, then scaling to national customer service.
Algorithmic accountability and audit	Independent verification, audit trail, traceability; complaint handling and correction.	Full logging for automated decision support; annual independent audit.
Customer-centric service design and engagement	Co-design by life stages; understandable communication; accessibility (A11y).	Voice-based channels for older customers; simple forms.
Responsible use of predictive analytics	Validation, drift monitoring, human review; risk communication.	Forecasting payment peaks and customer traffic for capacity planning.
Fraud/abuse monitoring with AI	Anomaly detection, real-time alerting; ethical thresholds and human verification.	Identify suspicious payment patterns and identity fraud.
Digital architecture and interoperability	Unified identification, consent management, standardized data exchange (API, SLA).	"Pension overview" dashboard ecosystem with provider integrations.
Skills development in the public sector	AI literacy at all levels; advanced/specialist competencies; ethics.	Agents use genAI tools for summarization and knowledge discovery.
Impact assessment and monitoring	Continuous performance and risk monitoring; measurement of public service value.	Tracking AI KPIs and public service outcomes in pension administration.

Table 1.

Opportunities for AI in the pension system based on OECD recommendations

Source: Own compilation based on OECD [3]

Hungary's Artificial Intelligence Strategy (2020-2030) [15] is a flagship of the concept of a "data-driven service state" and the use of trustworthy AI. The Hungarian AI Strategy was updated in 2025 [16], with a promise of an annual

review, with a special focus on social applications (education, healthcare, public services).

Although the document pays significant attention to the development of public services, it does not highlight the pension system as a separate sectoral target area. The strategy does not specifically address the pension system, but the digitalization of public services and data wallet-based services can offer indirect benefits to the pension age group. Such benefits could include automated administration, which can facilitate the submission of online pension-related applications and the modification of data, and the use of data wallets can enable personalized administration, such as the easy updating of data required for pension calculations. Increased digitalization in e-government can also be beneficial by reducing the digital divide between generations [16].

4 The AI options in self-care

According to forecasts, the number of pensioners will increase drastically, and this process cannot be significantly changed in the short term. The Hungarian pension system is currently built on two pillars: the first pillar is the state, pay-as-you-go pension system, while the second pillar operates on the basis of the funded principle [17] [18]. In the current pension system, choosing a voluntary pension fund can be an additional element of ensuring livelihood in old age. A voluntary pension fund can enable us to maintain the standard of living we have become accustomed to during our active years upon pension. These institutions complement other pension savings, such as pension insurance. In the general public perception, a pension is the pension that a country's elderly citizens receive on a subjective basis, i.e. not on the basis of need. The amount depends on the length of service, i.e. the number of years spent working, and previous income (earnings) [7]. This definition reflects the public opinion, according to which the concept of pension is exclusively related to social security benefits.

However, a pension can be considered any regular old-age income to which we are entitled during our active years. Thus, regular income from pension savings can also be considered a pension. It should be made aware that there is no state benefit that can promise an adequate pension for everyone in all cases. In other words, the role of individual responsibility is valued more in order to maintain financial security in old age. In addition to increasing taxes and contributions and further raising the pension age, there is also a more effective and sustainable solution, which is called self-care. This means that people create a private pension fund for themselves that allows them to live a full life in old age. This also relieves the burden on the state, because although they are being helped by the state, they are putting aside money for private purposes. They are managing their own assets and are not paying more into the common fund. There are many ways to save for pension [19].

Recommendation	Description	Hungarian practice
Personal pension dashboard (multi-source)	A personalized online interface that automatically brings together legal relationships and savings from multiple sources (state, employer, voluntary); interactive overview and action suggestions.	There is no national pension dashboard integrated from multiple sources. E-administration in the SZÜF/Ügyfélkapu+ framework; thematic pages on the MÁK website.
Interactive ‘what if’ calculators	User-modifiable parameters (deposit, trajectory, yield), instant forecasts and decision suggestions to support planning.	MÁK Self-service pension calculator (based on service time/earnings); calculator for several voluntary pension funds (ÖPOSZ, OTP).
Payout phase planners	Comparison of payout alternatives (annuity, periodic annuity, lump sum); payout strategy tailored to individual needs.	Annuity calculators are available from voluntary funds (e.g. Erste). On the state side, the focus on determination dominates, and uniform payout planning is less supported.
Communication and education (OECD/INFE)	Plain language guides, financial education built into the interface; measurement with OECD/INFE questionnaires and competency framework.	Strong educational ecosystem (PÉNZ7, Pénziránytű, MNB). The level of knowledge is outstanding, but financial behavior and practical application need to be improved.
Return/risk indicators	Portfolio recommendations and market simulations based on risk profile; transparent return communication on the dashboard.	Voluntary funds have yield simulators (OTP, Aranykor). There is no uniform yield/risk illustration on the state platform.
Automatic data interoperability	The key to a dashboard is data connectivity, real-time updates, and auditability – integrating multiple sources according to standards.	This identification works (Customer Portal+ / DÁP), but multi-source pension consolidation is not common.
System statistics in the custom view	Combining macro indicators (average, median, regional breakdown) and individual context in decision support.	KSH STADAT detailed pension statistics (average, median, regional breakdown) are available, but are not integrated into personalized interfaces.
Action-oriented ‘nudge’ functions	Reminders, goal tracking, automatic deposit increases, and decision guides to encourage actual savings steps.	These administration and fund campaigns are available, but system-level nudge frameworks are not common on the pension platform.

Table 2.

Opportunities for the application of AI in self-care based on OECD recommendations

Source: Own compilation based on OECD [3]

The OECD outlines key opportunities and recommendations for the application of AI in self-care and decision support for individual pension savings, which are summarized in Table 2 with descriptions and domestic implementation practices. The OECD recommendations build support for individual pension savings on a

comprehensive, multidimensional approach. Together, these elements increase financial awareness, help make more informed decisions, and thereby improve the quality of life of people of pension age [3].

Conclusions

One of the main challenges facing Member States' pension policies is to develop pension systems that are financially sustainable in the long term, while fulfilling the fundamental purpose of pension systems: to ensure an adequate income and standard of living for older people, as well as their economic independence. This requires the establishment of an institutional system that is capable of creating the financial cover necessary for the security of a retired society in the long term. AI has significant potential in the field of pension security, especially in the areas of forecasting, personalized advice, administration and risk management. At the same time, the introduction of AI technology requires responsible regulation, ethical considerations and social dialogue. In order for Hungary to have an economy that adapts to inevitable demographic processes, a more serious paradigm shift and the inclusion of new technologies – such as AI technologies – are needed in terms of the sustainability of the economic environment and pension security.

An ageing population, increasing life expectancy and changing employment structures are undermining the balance of pay-as-you-go models, while market volatility and inflation are challenging funded systems. AI is already a proven performance-enhancing technology in government and financial services, especially when combined with sound governance. In most European Union countries, public systems play a central role in enabling people to reasonably maintain their standard of living during their working years and beyond. AI offers breakthrough opportunities in the area of pension security in three main directions. On the one hand, it can improve macro-level forecasts and risk management, which are essential for planning long-term financial sustainability. On the other hand, it can support individual financial decisions with increasingly precise, personalized savings and investment recommendations. Thirdly, it provides an opportunity to digitize and automate pension administration and payment processes, which can significantly reduce operating costs, increase efficiency, and improve the customer experience.

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