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DIGITAL TRANSFORMATION AND GREEN ECONOMY: APPLICATION AND CHALLENGES IN THE INSURANCE SECTOR

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Abstract: The paper analyzes contemporary trends in the digital transformation of the insurance sector through the application of information technologies, artificial intelligence, and digital communication channels, with a particular focus on their connection to the development of the green economy. The digitalization of business processes contributes to more efficient risk management, reduced administrative costs, and more rational use of natural and energy resources, thereby enhancing environmental sustainability and reducing the negative impact of the insurance sector on the environment. The use of artificial intelligence includes risk assessment, claims automation, fraud detection, and offer personalization, which increases decision-making accuracy and optimizes business processes. The role of social networks in client communication promotes transparency, public engagement, and awareness of responsible and sustainable consumer behavior. Identified trends – such as the integration of artificial intelligence and blockchain technologies, the rise of InsurTech startups, and the introduction of "green" insurance products (e.g., insurance for renewable energy and climate risks) – indicate a shift of the sector toward a business model based on the principles of environmental, social, and corporate governance (ESG). Based on a review of the literature and available case studies, the key obstacles to the successful implementation of digital transformation have been identified, including regulatory inconsistencies, high implementation costs, and the lack of digital competencies in Serbia's insurance sector. The aim of the paper is to highlight the

importance of digital transformation as a driver of the green transition and to propose guidelines for the further development of ESG-oriented business models in the domestic insurance sector.

Keywords: *digital transformation, insurance, green economy, sustainability, ESG.*

INTRODUCTION

Digital transformation represents one of the most significant drivers of change in the modern economy and financial services, including the insurance sector. The rapid development of information technologies, artificial intelligence (AI), big data analytics, and digital communication channels is transforming the way insurance companies manage risks, assess clients, develop new products, and interact with the market [1]. This process involves not only technical modernisation but also a profound transformation of business models, organisational culture, and approaches to sustainability. At the same time, global trends of the green economy and the implementation of ESG principles (Environmental, Social, Governance) are setting new standards of responsible business conduct in the financial sector. By integrating digital technologies with environmental, social, and governance dimensions of business operations, a new development paradigm is being formed, in which the competitiveness of insurers increasingly depends on sustainability, transparency, and social responsibility [2]. As a key mechanism of financial stability, the insurance sector stands at the centre of this transformation. Digital solutions enable automation and acceleration of processes, cost reduction, more precise risk management, and the development of innovative products aimed at climate and environmental challenges [3]. Simultaneously, digitalisation contributes to environmental efficiency by reducing material consumption, promoting electronic business processes, and enabling monitoring of ESG metrics.

The aim of this paper is to analyse, based on relevant domestic and international literature, the relationship between digital transformation and the green economy in the insurance sector, to identify the main forms and directions of digital technology application, and to highlight the challenges and perspectives of their implementation in the context of sustainable development. The research covers three interrelated segments: (1) an analysis of contemporary forms of digital transformation in insurance, (2) an overview of global trends in investments in digitalisation, and (3) an examination of the relationship between digital innovations, ESG principles, and green business models.

Application of Digital Transformation in the Insurance Sector – Forms, Advantages and Challenges

Digital transformation in the modern insurance sector does not represent mere technical modernisation, but a deep organisational and strategic change in the way business operations, risk management, and client relations are conducted [4]. According to Banožić (2020), digitalisation in the insurance industry includes a shift from traditional, paper-based processes to automated and intelligent systems that enhance efficiency and service accessibility [1]. This process has been globally accelerated by the development of InsurTech start-ups, the adoption of artificial intelligence (AI), blockchain, and big data analytics, transforming the entire value chain in the insurance industry. The changes resulting from digital transformation in insurance refer to:

1. The way new technologies reshape interactions between insurers and policyholders, which can now take place through social networks and virtual advisors;
2. The way technologies and tools can be used for automation, standardisation, and efficiency improvement of business processes through online sales, digital claim registration, and automatic contract activation enabled by blockchain; and
3. The opportunities new technologies provide for modifying existing insurance products and developing new, 'green-oriented' ones [5].

The introduction of electronic insurance policies (e-policies) and digital onboarding of clients (the digital process of client registration and verification) represents a fundamental step in the digital transformation of the insurance industry [1]. This model enables electronic identification (KYC), contract signing via qualified e-signature, and automatic document archiving. According to Glušac (2021), the digital form of insurance policies provides numerous benefits: reduced contract completion time, lower administrative costs, and a higher level of legal security, as transactions can be tracked in real time [6]. At the same time, the transition to e-policies contributes to reduced paper consumption and has a positive effect on the sector's environmental sustainability.

One of the most important changes refers to the use of Big Data and Internet of Things (IoT) technologies in risk assessment and premium determination models [7]. Telematics in motor insurance and home sensors in property insurance enable the introduction of tariffs based on actual customer behaviour ('pay-how-you-drive', 'pay-how-you-live') [5]. Usage-Based Insurance (UBI) leads to the development of new, personalised insurance products [8]. Among the most commonly used models are Pay As You Drive (PAYD), Pay How You Drive (PHYD), Manage How You Drive (MHYD), and Pay How and How Much You Drive (PHHYD). The key feature of these models is that insurance pricing is determined based on new data sets such as the time of day when driving occurs, the distance travelled, driving behaviour, speed, and other factors. In health and life insurance, similar functions are performed by smart watches, fitness bands, and other wearable devices capable of monitoring pulse rate, blood pressure,

oxygen levels, activity (steps, hours of sleep), geolocation, calorie consumption, food and water intake, and blood sugar levels. These technologies enable the personalisation of health insurance products under the Pay As You Live (PAYL) model [5]. Such contracts are based on risk assessments derived from variations in these parameters, which can serve a dual purpose: they may be used for risk prevention by rewarding policyholders with healthy lifestyles through lower premiums, and they can provide assistance in the event of medical emergencies or accidents (triggering alerts and contacting emergency services). McKinsey (2022) estimates that the application of these technologies can reduce processing costs by up to 30%, while insurers simultaneously achieve more accurate segmentation and greater customer loyalty [9].

In modern insurance, artificial intelligence (AI) is transforming underwriting by:

- automating data processing related to clients and risks;
- applying algorithms and machine learning for more accurate probability assessments of claims;
- enabling personalised premiums, automated claims handling, and faster decision-making;
- reducing human error and operational costs.

According to a KPMG (2023) survey, as many as 58% of insurance executives expect a return on investment in AI technologies within five years [10]. AI is used for risk modelling, anomaly detection, and policy pricing optimisation according to clients' individual characteristics.

One of the areas where digital transformation shows the most visible results is automated claims processing [11]. Through the use of AI-powered image analysis (computer vision), OCR technologies, and online claims submissions (First Notice of Loss – FNOL), processing times are drastically reduced. OCR (Optical Character Recognition) technology enables the automatic recognition and conversion of text from scanned documents, images, and PDF files into a digital, searchable format [12]. Its application significantly accelerates claim handling, reduces the likelihood of human error, and contributes to full process automation. McKinsey estimates that digital models can reduce claims-handling costs by 25–30%, while simultaneously decreasing the number of errors and fraud cases.

Fraud analytics and Natural Language Processing (NLP) enable the identification of suspicious patterns in claims, medical invoices, and internal reports. An insurance company receives thousands of invoices from various repair shops after vehicle damage claims are processed. The invoices are in PDF format, often scanned, and differ in layout, language, and terminology.

The task of the NLP system is to automatically:

- Extract data from the invoices (service name, invoice number, date, amount, VAT, description of services, chassis number, vehicle registration, and claim reference number).

- Understand the context and categorize costs – for example, "bumper replacement," "painting," "mirror replacement," or "towing service."
- Compare cost items with standards (price lists, average labor time) and flag suspicious values (e.g., excessive repair duration, unusually high prices of parts or services, etc.).
- Link the document to the corresponding claim record in the insurer's database.

Chatbots and virtual assistants based on AI technologies greatly improve customer communication. They enable continuous service availability, provide information on policy status, and receive client requests without intermediary agents. Kuppan et al. (2024) highlight that such solutions increase customer satisfaction and reduce operational costs by automating routine queries.

Robotic Process Automation (RPA) is used to perform repetitive administrative tasks such as data entry, payment verification, database updating, and document control. According to McKinsey (2022), this approach reduces operational costs by up to 40% in certain segments. RPA also enables a transitional stage of digitalisation until fully integrated solutions are implemented.

Blockchain technology ensures a high level of transparency and trust in contract execution, especially in parametric insurance [5]. According to Fedorovych et al. (2025), smart contracts reduce administrative costs and processing time, as payouts are automatically triggered once contractual conditions are met. However, limitations arise from the need for reliable data sources and still inconsistent regulatory frameworks.

"Green Insurance" and Its Application in the Modern Market Environment

Due to accelerated climate change, an increase in extreme weather events, and growing social pressure for sustainability, the insurance sector is facing both the challenge and the opportunity of adapting to the requirements of the green economy. One of the responses to this challenge is the emergence of new insurance products based on the principles of the green economy – so-called green insurance or sustainable insurance. These products integrate environmental and social aspects into insurance policies, thereby contributing to the transition towards a low-carbon and more resilient economy.

Types and Applications of Green Insurance Products

In the global insurance market, there are several types of green insurance that differ in their purpose, method of application, and degree of contribution to sustainable development. In this context, the most common types can be identified as follows:

1. Renewable Energy Insurance

This type of insurance covers risks related to the construction and operation of solar power plants, wind farms, and hydroelectric facilities. Swiss Re and Allianz have developed specialised policies covering construction risks, equipment damage, business interruption, and loss of energy production. Swiss Re has established a Renewable Energy Centre of Competence, providing solutions for solar, wind, and battery systems worldwide [13].

2. Parametric Climate Insurance

In this type of insurance, the payout is triggered when a defined climatic parameter (e.g., rainfall amount, temperature, wind speed) reaches a predetermined threshold, without the need for damage assessment[14]. Swiss Re, AXA Climate, and Munich Re offer parametric products for agriculture, tourism, and the energy sector, particularly in countries exposed to high climate risk. AXA Climate, for example, develops digital models for risk assessment and automated payouts.

3. Green Property Insurance

Insurers offer special conditions for properties that meet energy efficiency standards, use eco-friendly materials, and reduce carbon emissions. Following damage, the insurance covers reconstruction using green materials. Zurich Insurance Group and Allianz provide green building policies that include reimbursement of certification costs (e.g., LEED, BREEAM) and installation of energy-efficient equipment [15].

4. Green Motor Insurance

Within sustainable mobility policies, many companies offer discounts to users of electric and hybrid vehicles, as well as coverage for risks associated with batteries and chargers[16]. AXA, Allianz, and Generali have developed products that include an eco-bonus system – lower premiums for low-emission vehicles and telematics devices that monitor fuel consumption and driving style (pay-as-you-drive models).

5. Environmental Liability Insurance

This product covers costs of pollution clean-up, third-party damage claims, and losses associated with environmental degradation. AIG and Chubb provide advanced Environmental Protection Programmes covering risks from industrial and energy facilities [17], while Munich Re develops solutions for pollution arising from industrial production processes.

6. Carbon Credit and Transition Risk Insurance

A new segment of the insurance market focuses on covering risks related to carbon credit trading and decarbonisation projects. In 2023, Swiss Re launched long-term carbon credit insurance for large-scale carbon offset purchases [18], while Zurich is developing transition risk policies to protect companies from financial risks associated with the shift towards low-carbon technologies.

7. Green Life and Health Insurance

In the field of life and health insurance, there is a growing number of policies that offer lower premiums to policyholders who maintain a healthy and environmentally responsible lifestyle – for example, using public transport or bicycles, buying local products, and reducing energy consumption [19]. RGA and Aviva are developing products aimed at so-called green consumers, integrating ESG criteria into life insurance investment portfolios.

Contemporary Trends in Green Insurance

Green insurance represents an important step in transforming the financial sector towards sustainable development. The world's largest insurance companies – such as Swiss Re, Allianz, AXA, Zurich, Munich Re, Generali, and AIG – are introducing a broad range of innovative products that combine traditional insurance mechanisms with ecological and socially responsible components. Thus, insurance no longer serves only as an instrument of risk protection, but also as a strong driver of sustainable transition and green investment [20].

Global new investments in renewable energy reached 358 billion US dollars in the first six months of 2023, representing a 22% increase compared to the same period of the previous year. The reinsurance company Swiss Re expects continued growth in this sector, which will create an increased demand for insurance. Swiss Re researchers predict that investments in green energy will lead to additional insurance premiums related to the energy sector amounting to 237 billion USD by 2035, as shown in Figure 1.

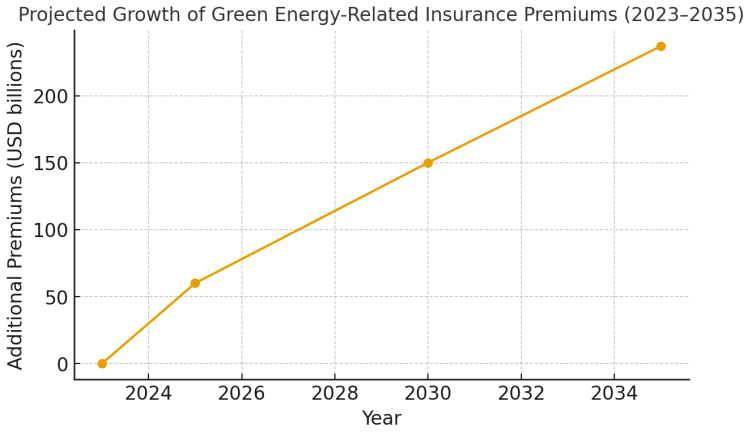

Figure 1. Projected Growth of Green Energy-Related Insurance Premiums (2023–2035)
Source: Author's calculation based on [21]

Insurers participating in the green transition are facing increasingly complex risks. Accelerated technological development, the complex structure of sustainable projects, and the uncertain effects of climate change contribute to the lack of relevant data and knowledge necessary for accurate risk assessment and adequate underwriting. The development of the renewable energy insurance market shows significant regional differences, reflecting the economic and technological capacities of individual countries.

Figure 2. presents the projected compound annual growth rate (CAGR) of the renewable energy insurance market across different regions for the period 2025–2030. The highest growth is expected in North America and parts of Western Europe, driven by substantial investments in renewable energy and supportive regulatory frameworks, while moderate or lower growth rates are anticipated in developing countries due to slower implementation and insufficiently developed regulations.

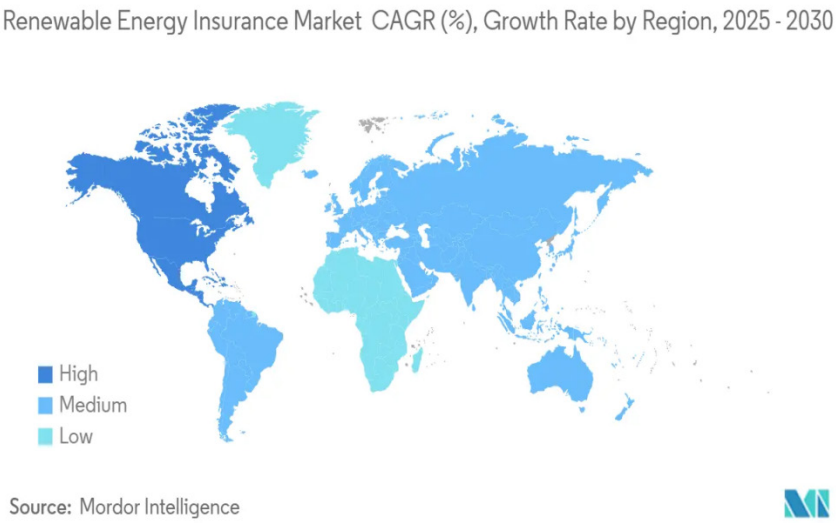

Figure 2. Renewable Energy Insurance Market Growth Rate by Region (2025–2030) [22]

Investments in Digital Transformation in the Insurance Sector – Global Trends

Investments in digital transformation within the insurance sector have recorded exponential growth over the past decade. According to research by Fedorovych et al. (2025), the market value of artificial intelligence in the insurance industry amounted to USD 4.59 billion in 2022, while it is expected to reach USD 141.44 billion by 2034 [11]. This dynamic, illustrated in Figure 3., clearly indicates the accelerated integration of advanced technologies and the transformation of business models within the insurance industry.

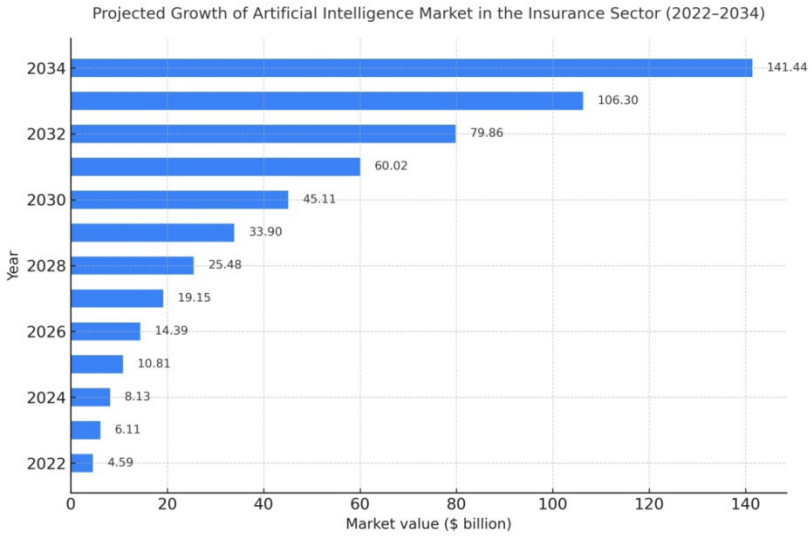

Figure 3. Dynamics of the Artificial Intelligence Market in the Insurance Sector (2022–2034) [23]

The growth of investments is primarily the result of the need for process automation, optimisation of risk management, and the enhancement of customer experience through personalised digital products. At the same time, the development of InsurTech companies has contributed to the expansion of innovative solutions in risk assessment, claims processing, and fraud prevention. A large number of traditional insurers are increasingly investing in AI, IoT, blockchain, and big data analytics, opening up opportunities to transform the role of insurance from a passive mechanism of loss compensation into a proactive system for managing risk and sustainability. However, this growth is not evenly distributed on a global scale. The highest concentration of investments has been recorded in developed markets – the United States, Western Europe, and Japan – while developing countries, including the region of Southeast Europe, are only beginning the process of digital adaptation [9]. Therefore, investments in digital infrastructure and strengthening digital competencies represent key prerequisites for a successful transition and greater integration of domestic insurers into global flows.

Digital Transformation as a Driver of the Green Economy and ESG-Oriented Business

Digital transformation in the insurance sector has multiple implications for the process of green transition and the achievement of sustainable development goals. In contemporary practice, it is not viewed solely as technological progress, but as an instrument for realising the principles of sustainability, social responsibility, and sound corporate governance – all of which are encompassed within the ESG (Environmental, Social, and Governance) framework.

One of the most significant contributions of digital transformation is the introduction of "green" insurance products that encourage investments in renewable energy sources, electric vehicles, energy-efficient buildings, and technologies for reducing CO_2 emissions. In practice, this includes the development of policies offering discounts for environmentally responsible behaviour – for instance, lower premiums for owners of electric vehicles, solar installations, or energy-efficient households [9]. Such models, known as green insurance and eco-bonus programmes, simultaneously promote sustainable habits and reduce the overall risk in insurers' portfolios [24].

Digital tools such as blockchain, artificial intelligence, and big data analytics play a key role in measuring and verifying ESG indicators [24]. Blockchain ensures transparency and immutability of ESG reports, while AI analyses large datasets on emissions, resource consumption, and supply chains, allowing for more precise ESG assessments. Deloitte highlights that the application of advanced analytics also improves climate risk management, as insurers can model climate change scenarios and predict long-term impacts on investment portfolios [3]. With the development of digital platforms and InsurTech services, access to microinsurance and parametric products is increasing in low-income countries, making insurance an instrument for strengthening community resilience to climate and social risks [25].

In the context of Serbia and the countries of Southeast Europe, the transition towards digital-green business models is still in its early stages. Research indicates that investment in digital infrastructure, regulatory reform, and employee education is essential to align the insurance sector with ESG standards and the guidelines of the European Green Deal. In this regard, digital transformation is recognised as a strategic driver of sustainability, as it enables transparent reporting, reduced material consumption, and more efficient use of resources.

Banožić emphasises that a successful digital strategy in insurance must simultaneously contribute to financial efficiency, social responsibility, and environmental protection – representing the key intersection between digital and green transitions. It can therefore be concluded that the future of the insurance sector will be defined by the extent to which digital technologies are successfully integrated with the principles of sustainable business, in accordance with ESG objectives and the requirements of the green economy.

Challenges and Difficulties in Implementing Digital Transformation in the Insurance Sector

Despite the undeniable benefits of digital transformation, its implementation in the insurance sector faces numerous challenges that slow down the full integration of digital technologies and disrupt business continuity. According to Fedorovych et al. (2025), the main obstacles include regulatory restrictions, high implementation costs, issues of data quality and protection, as well as a lack of digital competencies among employees.

Regulatory and legal challenges represent one of the key problems. Digital transformation requires the adaptation of existing legal frameworks to new forms of contracts, electronic policies, and online communication between insurers and policyholders. Research indicates that regulatory barriers are among the greatest obstacles to introducing innovative technologies, especially in the field of personal data protection and the security of electronic documents [5]. Glušac (2021) points out that the current legal framework in Serbia is only partially aligned with modern digitalisation trends, but it does allow for the use of electronic policies and e-insurance contracts.

According to Deloitte (2023) and WRMA (2022) reports, numerous technical and infrastructural barriers have been identified in the process of digitalizing the insurance sector. This process requires the modernization of IT infrastructure, the implementation of advanced cloud solutions, and the integration of data from multiple sources, which demands substantial financial investments and increases the risk of cyberattacks.These processes demand substantial investments and increase the risk of cyberattacks. The implementation costs of artificial intelligence and automation are particularly high for small and medium-sized insurers, resulting in digital inequality between larger and smaller market participants[25].

Organisational and human-resource barriers also have a considerable impact. Digital transformation implies a change in organisational culture, which often provokes employee resistance towards new technologies. A lack of digital skills and qualified professionals slows down automation and data-management processes. According to the study Knowledge Management for Improved Digital Transformation (2024), the main problems lie in weak knowledge integration, insufficient training programmes, and low employee motivation to adopt new technologies. Additionally, the absence of a clear digital governance strategy and the misalignment between IT and business objectives make the practical implementation of digital transformation more difficult.

Security and customer trust constitute another critical aspect. As the volume of digital transactions increases, so does the risk of cyberattacks and data breaches, which may lead to a loss of customer confidence. Studies show that client trust is a crucial condition for the success of digital insurance platforms, as security incidents directly affect the insurer's reputation.

It can therefore be concluded that the introduction of digital transformation in the insurance sector is a multi-layered process that requires the simultaneous reso-

lution of regulatory, infrastructural, and human-resource challenges. The successful implementation of digital solutions largely depends on insurers' ability to align technological development with legal frameworks, ethical standards, and customer expectations [11]. Effective digital transformation is not possible without an adequate knowledge-management (KM) system. Elgargouh et al. (2024) confirm that knowledge and internal expertise are critical factors for successful digitalisation in the insurance industry. KM systems enable the capitalisation of experience, reduction of knowledge-loss risks, and faster employee training.

The connection between digital transformation and the green economy is reflected in the concept of ESG-oriented business. Digital tools enable the monitoring of ESG metrics and the development of products that reward environmentally responsible behavior, such as discounts for electric vehicles or solar installations. Digitalisation contributes not only to reduced material consumption but also to improving the reputation and transparency of insurers in the marketplace.

Although digital transformation poses challenges in terms of regulation, security, and digital skills, it has proven to be a key driver of competitiveness and sustainability in the insurance sector. A successful digital strategy in insurance must simultaneously enhance financial efficiency and social responsibility, which together form the foundation for connecting digital and green transitions.

CONCLUSION

Digital transformation in the insurance sector has proven to be a key driver of business-model modernisation and the creation of new value based on sustainability. By integrating advanced technologies: artificial intelligence, the Internet of Things, blockchain, and big-data analytics, insurers not only improve operational efficiency but also actively contribute to achieving the goals of the green economy.

Process automation, electronic policies, and digital risk management lead to reduced resource consumption, energy optimisation, and greater business transparency, directly lowering the sector's ecological footprint. The role of digital transformation in developing the green economy is particularly evident through the application of ESG principles (Environmental, Social, and Governance). Digital tools enable accurate monitoring and measurement of ESG indicators, the development of green insurance products, and the management of climate and environmental risks based on real-time data. In this way, insurance companies become not only financial intermediaries but also active participants in achieving sustainable development goals. However, the successful implementation of these technologies requires overcoming numerous challenges, from regulatory inconsistencies and high implementation costs to a lack of digital skills and infrastructure. These factors represent major obstacles to the full integration of digital-green business models, particularly in developing countries such as Serbia.

Future development perspectives clearly indicate that digital transformation will become a pillar of the green transition in insurance. Its value lies not only in economic effects but also in its contribution to ecological and social sustainability. Creating synergy between digital innovation and ESG principles provides the foundation for building a resilient, transparent, and socially responsible insurance sector – one capable of responding to the challenges of climate change and the demands of a modern, knowledge- and sustainability-based economy.

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