



Basics of Green Digitalization - Overview and Theory Content

November, 2023

Content

INTRODUCTION IN GREEN DIGITALIZATION	3
INTERNATIONAL AND NATIONAL POLICY FOR GREEN DIGITALIZATION	5
STATE OF THE GREEN DIGITALIZATION IN BULGARIA	12
FACTORS FOR SUCCESSFUL GREEN DIGITALIZATION	19
GOOD PRACTICES OF GREEN DIGITALISATION	38
LESSONS LEARNED AND PERSPECTIVES	38
GREEN DIGITALIZATION AT CONSUMER LEVEL.....	41
REFERENCES.....	46

Introduction in Green Digitalization

WHAT IS GREEN DIGITALIZATION

"Green digitalization" generally refers to the use of digital technologies and innovations to promote sustainability and environmental responsibility. This concept encompasses various strategies and practices that leverage digital tools to reduce the environmental impact of human activities and contribute to the overall goal of a more sustainable future. Some key aspects of green digitalization include:

- **Energy Efficiency:** Implementing digital technologies to optimize energy consumption in various processes and systems. This can include using smart grids, energy-efficient algorithms, and monitoring systems to reduce overall energy usage.
- **Smart Cities:** Integrating digital solutions to enhance the efficiency of urban infrastructure, transportation, and public services. This can lead to reduced energy consumption, improved waste management, and more sustainable urban planning.
- **Renewable Energy Integration:** Utilizing digital tools to enhance the integration of renewable energy sources into the power grid. This involves smart grids, energy storage solutions, and predictive analytics to better manage and distribute renewable energy.
- **Data Analytics for Sustainability:** Applying data analytics and artificial intelligence to gain insights into environmental issues and optimize resource use. This includes monitoring and analyzing data related to energy consumption, emissions, and waste to identify areas for improvement.
- **Remote Collaboration and Telecommuting:** Using digital communication technologies to enable remote work and virtual collaboration, thereby reducing the need for physical commuting and lowering associated carbon emissions.
- **Circular Economy:** Employing digital technologies to support a circular economy by tracking and optimizing the use of resources throughout their lifecycle. This includes improved product design, recycling processes, and waste reduction strategies.
- **Eco-friendly Technologies:** Developing and adopting digital solutions that are designed with environmental sustainability in mind. This can include the use of eco-friendly materials in manufacturing and prioritizing products with low environmental impact.
- **Carbon Footprint Monitoring:** Implementing digital tools to measure and manage carbon footprints across various sectors. This involves tracking and reporting emissions, setting reduction targets, and implementing strategies to achieve them.

WHEN STARTED DEVELOPMENT THE CONCEPT OF GREEN DIGITALIZATION

The concept of green digitalization has evolved over time, and it doesn't have a single specific starting point. However, discussions around the intersection of environmental sustainability and digital technologies gained momentum in the early 21st century. As concerns about climate change and environmental impact increased, industries and researchers began exploring ways to leverage digitalization for green purposes.

Here are some key milestones and developments.

1. **Early 2000s:** The idea of using digital technologies for environmental sustainability started to gain attention. Concepts such as "smart grids" and "smart cities" emerged, focusing on the use of digital systems to enhance energy efficiency and urban sustainability.
2. **Mid-2000s:** The term "Green IT" gained popularity, referring to the practice of using information technology resources in an environmentally responsible manner. This involved strategies to reduce energy consumption in data centers, improve the energy efficiency of IT equipment, and promote responsible e-waste disposal.
3. **Late 2000s - Early 2010s:** The push for sustainability in the IT sector continued, and discussions expanded to include broader concepts like "sustainable ICT" and "green computing." Efforts were made to develop standards and certifications for environmentally friendly practices in the tech industry.
4. **2015 and Beyond:** As the Internet of Things (IoT), big data, and artificial intelligence gained prominence, discussions around using these technologies for environmental monitoring, resource optimization, and sustainable development increased. The term "green digitalization" began to encompass a broader range of digital technologies and their role in promoting overall environmental sustainability.

Since then, governments, businesses, and organizations have increasingly integrated green digitalization practices into their strategies to address environmental challenges. The concept continues to evolve, and ongoing advancements in technology and sustainability practices contribute to its development. Keep in mind that these are general trends, and specific initiatives and discussions may have different timelines in various regions and industries.

*What is the **twin transition** in the context of green digitalization?*

The term "twin transition" is commonly used in the context of sustainable development and the economic changes required to achieve green digitization. "Twin transition" usually refers to the need to transform the economy and the ecosystem simultaneously to achieve sustainable growth and transition to a greener and more digital lifestyle and production.

1. **Ecological transition (green transition):** This aspect of the twin transition addresses the need to make the economy less ecosystem-draining and sustainable. This includes the transition to renewable energy sources, the reduction of greenhouse gas emissions, the conservation of natural resources and the sustainable use of land.
2. **Digital transition:** This aspect focuses on the integration of digital technologies in all aspects of the economy and society. The digital transition involves the use of new technologies such as artificial intelligence, the Internet of Things, blockchain and others to improve the efficiency, innovation and competitiveness of various sectors.

The combination of these two aspects in a twin transition means that the economy is transformed not only through the integration of new technologies, but also by taking into account and strengthening the priorities of environmental protection and sustainability. This approach aims to achieve a balance between economic growth and environmental protection.

International and National Policy for Green Digitalization

The international situation influencing the policies and implementation of Green Digitalization is related to the COVID-19 pandemic, the war in Ukraine, the climate and environmental threats.

Global challenges are outlined in the World Economic Forum's Global Risks Report 2023. It outlines the familiar risks of inflation, rising costs of living, trade wars, capital flight from emerging markets, widespread social unrest, geopolitical confrontation and nuclear war. They are exacerbated by new global risks such as: unsustainable levels of debt, low growth, low global investment and deglobalisation, a decline in human development after decades of progress, rapid and unfettered technological development and the increasing pressures of climate change.

The COVID-19 pandemic is still affecting the global economy. It causes local blockages that disrupt global supply chains and lead to product and resource shortages, affecting commodity markets, especially in countries with low purchasing power. In parallel, the pandemic is driving adaptability by accelerating the development of digital technologies. It leads to rapid digitization of many spheres and processes, the transition to remote and paperless offices, etc. It supports and facilitates rapid adaptation to new challenges. And telecommuting and other hybrid work models significantly reduce the need for travel, with a positive effect on the carbon footprint.

The war in Ukraine has a strong impact on green and digital technology transitions, outlining the importance of the geopolitical aspects of the transition to clean energy, highlighting the need to accelerate it and to join efforts to achieve a more sustainable energy system and a true energy union.

Climate and environmental threats are in the center of global green digitalization drivers. The burden on natural ecosystems is predicted to increase, with nature loss and climate change inextricably linked. According to the World Economic Forum's Global Risks Report 2023, "Without significant policy change or investment, the interplay between climate change impacts, biodiversity loss, food security and natural resource consumption will accelerate ecosystem collapse, threaten food supplies and livelihoods in climate-vulnerable economies, will increase the impact of natural disasters and limit further progress on climate mitigation."

The European Commission's 2021 Strategic Foresight Report lists climate change and environmental degradation, digital hyper-connectivity among the main megatrends expected to impact the open autonomy of the European Union (EU) in the coming decades and technological transformation, as well as pressures on democracy and values, and changes in world order and demographics. The Report highlights that the long-term consequences of Russia's military aggression against Ukraine, including for energy, food, economy, security, defense and geopolitics, will affect Europe's path towards a just environmental and digital transition.

The need for a transition to sustainable energy, to renewable energy sources, for increased energy efficiency and savings, as well as for the diversification of energy imports already in the short term, in order to achieve Europe's strategic autonomy, is at the heart of the REPowerEU Plan.

Climate mitigation and adaptation policies are institutionalized at the international level with the Paris Agreement of 2015, and at the European level with the European Green Deal (European Green Deal) – the roadmap for achieving sustainability of the EU economy and related policies. In the context of the European Green Deal, the European Commission (EC) notes that "climate change and environmental degradation are a threat to the very existence of Europe and the world. To meet this challenge, Europe needs a new growth strategy to transform the Union into a modern, resource-

efficient and competitive economy with no net greenhouse gas emissions by 2050, where economic growth is decoupled from resource use and no man and no place is neglected.”

In the context of climate change, significant environmental degradation and emerging energy import dependence, critical to the EU strategic autonomy, the Green Transition is a term that summarizes the European Union's drive to become more sustainable by reducing the impact on the environment, modernizing the economy and increasing its autonomy by becoming less dependent on energy and raw material imports. It launches a coherent cross sector strategy for a climate-neutral competitive economy with efficient use of resources and reduction of environmental degradation by 2050. The EC highlights the interconnection between the environmental and digital transitions by emphasizing their ability to reinforce each other.

The Green Deal is an integral part of the EC strategy to implement the United Nations 2030 Agenda and the Sustainable Development Goals.

In accordance with the European Green Deal, a new Action Plan on the circular economy has also been adopted. In the Plan, the EC states that the transition to a circular economy must be based on interrelated measures that provide a coherent product policy framework. This will lead to "sustainable products, services and business models and transform consumption patterns so as to prevent the generation of any waste" and thereby "reduce pressure on natural resources and lead to sustainable growth and job creation". The role of research, innovation and digitization is mentioned and it is predicted that with the help of digital technologies "the path of products, components and materials can be traced and secure access to the resulting data can be provided."

In the area of the digital transition, the EC adopts the 2030 Digital Compass: the European way for the Digital Decade, containing the vision, objectives, approaches and measures for a successful digital transformation of the European Union by 2030. The EC emphasizes that this "transformation is crucial and for the implementation of the transition to a climate-neutral, circular and sustainable economy".

By decision of the European Parliament and the Council, the 2030 Policy Programme 'Path to the Digital Decade' is adopted, which complements, implements and implements the vision, objectives and actions provided for in the Digital Compass communication, and aims to consolidate and ensure the effective implementation of the actions defined in the Strategy for Building Europe's digital future from 2019. The implementation of the Program sets out specific digital goals that the EU and Member States aim to achieve by the end of the decade. They are in four areas: strengthening digital skills and digital education, secure and sustainable digital infrastructures, digital transformation of enterprises, digitalization of public services.

'Fit for 55' Package is the European Climate Act, making it a legal obligation to meet the EU's climate target of reducing the Union's emissions by at least 55% by 2030. The 'Fit for 55' package is a set of proposals to revise and update EU legislation and introduce new initiatives to ensure that EU policies are in line with the climate targets agreed by the Council and the European Parliament.

The review of policies at the European level highlights a clear focus on the interconnectedness of the digital and environmental transitions. The range and variety of measures related to this complex transition, including technology development, manufacturing, business management through new business models, raw material planning, purchasing, talent development and more. etc., reflect the depth of the transformation that is understood under the name "twin transition".

Bulgaria's national policies in the areas of ecology and digitalization are a response to the challenges in the field of twin transition and are related to the relevant obligations under international agreements and policies of the European Union. The policies have a direct impact on the planning and implementation of green digitization measures by Bulgarian enterprises. In this regard, the main strategic documents of the country were also developed.

The National Recovery and Resilience Plan of the Republic of Bulgaria has a clear focus on the twin transition, with the Green and Digital dimensions of the Plan reaching, respectively, 53.66% and 23.60% of total resources. Thus, it lays the foundations for a green and digital transformation of the economy, in the context of the Green Deal, with Bulgaria contributing to the fulfillment of the pan-European goals for gradual decarbonization. In addition to efforts to reduce the carbon footprint, the Plan covers aspects of the green transition, such as water management and combating climate change, preserving biodiversity, focusing research and development on climate and environmental challenges, etc. Actions are directed in three main directions: (i) creation of conditions for accelerated implementation of renewable energy sources and hydrogen; (ii) enhanced actions to increase the energy efficiency of the economy; (iii) sustainable mobility.

In the context of the digital transition, the planned measures in almost all areas target elements mediating the digital transformation such as increasing the digital skills of the population, a reform model in the education system, and as a complementary nuance in the planned interventions in other policy areas (from culture to agriculture).

The National Development Program "Bulgaria 2030" provides the framework defining the vision and general objectives of the development policies in all sectors of the state government. Priority Green and Sustainable Bulgaria aims to increase the productivity of resources with an emphasis on the transition from landfill to prevention, reuse, recycling and utilization of waste. Priority Circular and low-carbon economy aims to transform the country's linear economy into a circular one. The Bulgarian economy has the highest resource intensity within the European Union and is in one of the first places in terms of generated waste per capita and GDP unit (16.85 tons per inhabitant). The main goal of the transition to a circular economy is to reduce the resource intensity of the country's economy and increase the efficiency of the materials used. It promotes the implementation of business models that enable interoperability between products and services throughout the supply chain, as well as design, reuse and recycling strategies that ensure longer use of products. A special focus will be placed on research and development (R&D) and innovation related to the circular economy and support for the development and implementation of green business models. Bulgaria places the circular economy as a long-term priority of its development policy.

The Government's Coalition Agreement contains a section dedicated to the circular economy. It includes a review and update of a strategy and action plan for the transition to a circular economy. Annex 11 "Environment and Water", related to the circular economy, envisages interaction with business and sustainable development, promoting sustainable patterns of consumer behavior and promoting the reuse of products and components; stimulation of environmental management system certification; introduction of technical requirements and guarantees that will objectively lead to compliance with European standards; promotion of eco-investments and eco-innovations; stimulating important sectors to be environmentally friendly; introduction of "electronic desks" to help businesses comply with environmental standards. According to the specific factors of the environment, it foresees a number of measures relevant to the twin transition, such as: eco-innovations in the field of climate,

digitization of forest management, implementation of innovative methods for measuring atmospheric air quality, use of new technologies, modernization of existing technologies ; building a national public system for statistics in the field of waste management; digital monitoring of the import of waste, subject to compliance with trade secrets, etc. The document does not provide specific commitments regarding the schedule and actions for the implementation of the agreed measures.

Strategy and Action Plan for the Transition to a Circular Economy of the Republic of Bulgaria for the period 2022-2027 includes three strategic goals: 1) green and competitive economy; 2) less waste, more resources and 3) consumer-friendly economics. The transition to a circular economy requires the creation of more sustainable models of production and consumption. The Strategy plans actions in this direction, with a commitment to provide resources and means for their implementation. The set measures are aimed at increasing the productivity of resources and ensuring connectivity in the economy by introducing new business models. Short-, medium- and long-term measures are specified in the Action Plan. Short-term measures include the drafting and adoption of sectoral legal acts relating to single-use plastics, green procurement, etc. This is Bulgaria's first step in developing a comprehensive circular economy policy agenda that shows some progress in implementing the priority actions set out in the 2019 Environmental Policy Performance Review.

The National Strategy for Small and Medium-Sized Enterprises 2021-2027 includes six priorities, one of which is Environment. The relevant measures are: support for improving energy and resource efficiency of enterprises and increased use of renewable energy sources; certification of environmental management enterprises; increasing their capacity regarding the transition to a circular economy; and promoting environmentally friendly products through the EU Ecolabel. Regarding the measure related to the circular economy, the aim of the Strategy is better inclusion of small and medium-sized enterprises in the circular economy, better recycling practices; more effective extended producer responsibility schemes covering more waste streams, wider use of secondary materials, including through industrial symbiosis.

Among the three main priorities of the Competitiveness and Innovation in Enterprises Program 2021-2027 is the circular economy. The measures cover: investments in the use of alternative raw materials, the use of recycled materials as raw materials and the reuse of materials; improving waste management in enterprises, including introduction of waste-free technologies; the production of "green products", incl. ecodesign; redirection of production from single-use products to reusable products and modernization of products to extend their life; more sustainable production processes with minimal use of chemicals and harmful substances; creation of partnerships between enterprises to achieve industrial symbiosis - sharing of resources, services, secondary products, creation of a link between productions where waste from one is raw material for another; industry platforms for the exchange of good practices.

The National Waste Management Plan 2021-2028 has a key role in achieving sustainable waste management characterized by efficient use of resources. Basic principles: waste as a vital resource and need for the state - a priority of the state policy and the policy of local self-government; application of scientific and technical achievements in waste management; application of economic regulators to achieve sustainable waste management and use of recycled materials/products obtained as a result of waste treatment; preventing or reducing the harmful impact of waste, in the context of climate change; preventing or reducing the formation of waste at the source of generation, in order to protect the environment and natural resources; providing conditions for optimizing the activities of

the recycling industry in the country and preserving the recovered resources in the European community; assessing the possibilities of obtaining material and energy resources from waste and ensuring their sustainable use. It includes the implementation of measures from the strategy for the transition to a circular economy regarding products containing raw materials of extreme importance for the EU and for Bulgaria, in order to prevent products containing such raw materials from becoming waste. Aimed also at increasing qualifications and skills for efficient use of resources within the ecological transition and circular economy and at raising awareness of practices and behaviors leading to sustainable consumption and the circular economy.

The Integrated Energy and Climate Plan of the Republic of Bulgaria 2021-2030 includes an integrated model for forecasting in the field of energy and climate and development of a long-term strategy in the field of climate. Defines as main goals those for stimulating low-carbon development of the economy, development of competitive and secure energy and reducing dependence on imports of fuels and energy. It requires comprehensive action in all areas of socio-economic relations, with a focus on economic sectors where the potential of existing productions for the entry of new technologies must be optimally used, ensuring a smooth and fair transition to a climate-neutral circular economy, as it is the hydrogen economy. It envisages investments in digital transformation and development of the information systems and real-time systems of the Electricity System Operator in the conditions of a low-carbon economy.

The National Climate Change Adaptation Strategy and Action Plan to 2030 sets out a framework for climate change adaptation (CAC) actions and priority areas until 2030, identifying and confirming the need for CAC actions both for the whole economy, as well as at the sectoral level. Disaster risk management is seen as a cross-cutting topic.

A specific goal in the Operational Program "Environment" 2021-2027 is to promote the transition to a circular economy. Measures related to the prevention of household waste generation, the construction of centers for preparation for reuse and repair, waste recycling, development of the separate waste collection system and raising awareness of practices and behavior in relation to sustainable consumption are envisaged. circular economy and waste monitoring.

Digital Transformation of Bulgaria for the period 2020-2030 defines the vision and goals of the country's digital transformation policy until 2030 as a generalized political framework of the National Program "Digital Bulgaria 2025", the National Development Program "Bulgaria 2030" and a number of others national strategic documents with a technological component. Key principles include: user-centric approach and access for all to digital services; ethical and socially responsible data access, use, sharing and management; technology as a key factor; cybersecurity by design; cooperation. It aims to: deploy a secure digital infrastructure – ensuring that no part of the country or group in society is left without adequate digital connectivity is at the heart of the development of a dynamic and innovative economy and provides better access for businesses to diverse, high quality and innovative digital services; ensuring access to adequate technological knowledge and digital skills; strengthening research and innovation capacity; unlocking the potential of data - connected data will be the main source that will power the digital economy, including the use of intelligent technological means with analysis and decision-making capabilities; increasing the efficiency of state administration and the quality of public services. Goal 5 is specifically oriented towards digitization in favor of a circular and low-carbon economy. Digitization is a driving factor of the circular economy and resource efficiency. It envisages technological change, to integrate products and services, to develop and implement

technologies that use less energy, reduce waste and avoid pollution, and to invest in a workforce with the right skills.

17 areas of impact are outlined, including: digital infrastructure, cyber security, research and innovation, education and training, labor market adaptation - education, training and social protection, digital economy, agriculture, transport, energy, environment and climate . The shift to product-service systems is recommended as one of the key solutions to accelerate the transformation to the circular economy. The combination of cyber-physical systems, large databases, data mining, data analysis, Internet of Things, is valued as a source of great opportunities for sustainable management of environmental components and factors, health, finance, culture, disinformation and media literacy, territorial development, digital governance, security and citizen participation in the democratic process.

Digital Bulgaria 2025 National Program aims to modernize and universally introduce smart IT solutions in all spheres of the economy and social life, by creating an environment for wide application of information and communication technologies, national infrastructure, innovative electronic services of a new type for business and citizens, uniform standards and achieving a high degree of network and information security and interoperability. Priority areas: creating appropriate conditions for the development of digital networks and services and better access to them, developing a dynamic and innovative digital economy and increasing its growth potential, increasing digital competences and skills, ensuring efficient and high-quality public e-services for business, citizens and government, fostering a secure cyber ecosystem - addressing cyber security challenges, internet governance.

Other national strategic documents in the field of environment are: Biodiversity Strategy of Bulgaria, Biodiversity Strategic Plan 2011-2020 "Natura 2000", National Strategy for Management and Development of the Water Sector in the Republic of Bulgaria, Strategic Action Plan for Environmental Protection and Rehabilitation of the Black Sea, River Basins Management Plans, Strategy for the Protection of the Environment in the Marine Waters of the Black Sea of the Republic of Bulgaria, Flood Risk Management Plans, National Air Quality Improvement Program (2018 - 2024), National Air Pollution Control Program (2020 - 2030), National Program for Conservation, Sustainable Use and Restoration of Soil Functions (2020-2030), National Action Program for Sustainable Land Management and Combating Desertification in the Republic of Bulgaria (Update for Programming Period 2014-2020), Long-term Strategy for Climate Change Mitigation by 2050, National Action Plan on Climate Change, National Strategy for the Development of the Public Procurement Sector in Bulgaria, as well as the Action Plan for the period 2014-2020, etc.

Other national strategic documents in the field of technologies: National Broadband Infrastructure Plan for Next Generation Access, National Strategy for Cybersecurity „Cyber Resilient Bulgaria 2020“ (Cybersecurity Strategy), National Strategy for the Development of Scientific Research in the Republic of Bulgaria 2017- 2030, National Roadmap for Research Infrastructure of the Republic of Bulgaria for the period 2020-2027, Framework Programme for Research and Innovation Horizon 2020, Strategy for Effective Implementation of Information and Communication Technologies in Education and Science in the Republic of Bulgaria (2014-2020), Implementation Plan of the Strategy for Effective ICT Implementation in Education and Science (2014-2020), National Employment Action Plan, Innovation Strategy for Smart Specialization 2014 - 2020, Concept for Digital Transformation of Bulgarian Industry (Industry 4.0), Digitalization Strategy of Agriculture and Rural Areas of the Republic of Bulgaria, Integrated Transport Strategy in the period until 2030, Strategy and National Plan for the

implementation of the European Rail Traffic Management System (ERTMS) in the Republic of Bulgaria, Strategy for the implementation of the Technical Specifications for Interoperability for the Conventional Railway System of the Republic of Bulgaria 2013 - 2030, National plan for the implementation of the Technical Specifications for Interoperability regarding the Subsystems "Control, management and signaling" of the Railway System in the EU, Strategy for the Development of Road Infrastructure in the Republic of Bulgaria 2016 - 2022 and Medium-term operational program for the implementation of the strategy, Digital Health Strategy 2021-2027, National Spatial Development Concept 2013-2025, Regional Spatial Development Schemes of Level 2 Regions, Municipal Integrated Development Documents, Updated e-Government Development Strategy 2019-2023, Roadmap for the implementation of the Updated Strategy for the Development of Electronic Government in the Republic of Bulgaria 2019-2023, etc.

State of the Green Digitalization in Bulgaria

The main challenges for Bulgaria identified in the implementation of environmental policies, according to the national report to the European Commission from 2022, summarize: the need to improve air quality despite some progress in the implementation of measures; the need to ensure proper collection and treatment of urban wastewater; waste management; the need for proper implementation of nature protection legislation. The priority is the adoption and implementation of a strategic long-term vision and an integrated approach for the circular economy, through which national policies accelerate the penetration of the circular economy in all economic sectors, as well as the implementation of measures to increase the percentage of circular use of materials.

The main challenges facing our country related to the digital transition include: weak digital skills of human capital; low levels of provision of digital public services; low levels of enterprise digitalisation – low uptake of digital technologies by small and medium enterprises (almost half of the EU average) and even lower uptake of advanced technologies such as artificial intelligence and cloud computing services.

Green Economy

In the last decade (2011 – 2020), the total number of enterprises in Bulgaria grew by 10.1%. However, the positive change is related to the decrease in the number of relatively larger enterprises and the increased number of micro-enterprises. For the same period, the revenues from the activities of the enterprises grew by 43.3%, which is significantly higher than the values for other European countries. On average for the EU-27, the growth rate is 13.0%. In Bulgaria, micro-enterprises perform best, where the reported revenue growth rate is 70.0%, followed by large enterprises with 43.4%.

However, with regard to the change in the number of employed persons, Bulgarian enterprises demonstrate serious weaknesses - this number increased by 0.8% for the period 2011-2020, with an average of 9.3% for the EU-27. Large enterprises performed well, where there was an increase in the number of employed persons by 6.3%, in the case of micro enterprises the increase was by 2.1%, and in the case of small enterprises, a decrease was reported by 4.7%. The weak indicators of Bulgaria are primarily due to the negative demographic developments, respectively to the severely limited supply of labor in the country. Despite the demographic restrictions regarding the labor market in Bulgaria, in the sectors of the circular economy the number of employed persons increased by 3.3% - about 52.3 thousand people, but the value of the growth rate for Bulgaria is significantly lower than that for EU-27 (13.2%).

At the same time, energy consumption in Bulgaria is growing significantly faster than the average for the EU-27 for the period 2012-2021. This applies both to the total consumption (11.4% against an average of 0.7%) and to the annual consumption of natural gas (11.3% at an average of 3.5%) and annual electricity consumption (11.2% at an average of 0.1%). In particular, in industry and services, Bulgaria is also significantly above the average values reported for the EU-27. While the structure of final energy consumption in Bulgaria is quite similar to that of the EU, in 2016 energy consumption per unit of GDP was 3.5 times higher than the EU average. Bulgaria is still the most energy-intensive economy in the EU and is lagging behind in its progress towards its indicative national energy efficiency target for 2020. Inefficient energy use prevents Bulgaria from exploiting the potential of its relatively

low energy prices and hinders the competitiveness of Bulgarian businesses and the economy as a whole.

Despite being on track to meet the 2020 renewable energy target, the country remains the EU's most greenhouse gas-emitting economy. Annual emissions of greenhouse gases from production activities in Bulgaria recorded a small decrease (by 3.3%), with an average of -16.6% for the EU-27. In terms of the carbon footprint of the economy, Bulgaria shows a relatively good performance. For the period 2012-2021, annual carbon dioxide emissions have decreased by 13.6%, with an average reported value for the EU-27 of -17.2%. Bulgaria's performance is very good in terms of the intensity of greenhouse gas emissions due to energy consumption, where the country reported a decrease of 17.3%, compared to an average decrease of 11.0% for the EU-27.

Annual waste generation in Bulgaria decreased by 27.8% for the period 2012-2020, while the decrease in the EU-27 amounted to only 4.0%. But it should be borne in mind that positive changes were registered in the manufacturing industry and in services - by 63.5% and 20.8%, respectively. The development in Bulgaria is unfavorable in terms of the level of packaging waste recycling, for which a drop of 5.3 per cent was reported – significantly larger than the dimensions for the EU-27 of 0.6 p.c. The results achieved by 2020 in terms of waste management do not correspond to good practices in the EU, and the application of circular economy business models is not yet sufficiently widespread among Bulgarian entrepreneurs.

At the same time, the country reports a large positive change in the rate of use of circular materials for the period 2012-2021 – 4.9%, although it is still well below the EU-27 average of 11.7%. As a share of private investments related to circular economy sectors (0.6%), Bulgaria is not far from the EU-27 average. The issue of resource and material efficiency remains relatively undervalued and Bulgaria is one of the countries in the EU with the lowest resource productivity.

At the beginning of 2020, only about a third of enterprises have an energy efficiency policy, 31.2% of them use environmentally friendly materials and resources, 28.9% have a policy for efficient use of resources and 71.4% of enterprises state that the machines they use and vehicles comply with environmental protection standards.

The share of green employment in total employment in Bulgaria is getting closer to the average level for the EU-27. For the period 2011–2017, this share increased from 0.9% to 1.5%, with an EU average of 2.0%. The structure of green employment shows that the largest share is observed in the sectors of production and distribution of electric and thermal energy and gaseous fuels; water supply; sewage services; waste management and recovery.

Sustainable and growing employment in these sectors also determines to a significant extent the development of the green and circular economy - for example, activities related to the production of renewable energy, recycling, etc. According to the latest data of NSI, more than half of green employment is precisely in them – 54.5% in 2017, and the growth in the number of employed persons for this period amounted to 31.3%.

The next most important sector for green employment is that of services - about a quarter of green jobs are positioned in it, and in 2017 the share of employees in the Services sector in the total green employment in the country amounted to 24.9%.

About one-ninth of the total green employment is in the Agriculture, Forestry and Fisheries sector (11.3% in 2017), one-ninth is also in Mining and Processing Industry, with the growth in the number of employed persons increasing by over 70% for the period 2014–2017. The situation with green jobs

in the Construction sector is unfavorable - they are relatively few, and the share of the sector in the total green employment has fluctuated around 1% in recent years. At the same time, precisely this sector should develop green employment due to the new EU trends, policies and standards related to the construction of environmentally friendly buildings.

In order to accelerate the transition of Bulgarian enterprises to the circular economy and to optimize their potential, it is necessary to engage all participants in the process. Targeted cross-sectoral efforts are needed to ensure that national commitments deriving from European legislation are respected. It is necessary to make efforts to increase the level of awareness and change the attitudes of the enterprises about the circular economy - the circular economy is not an obligation, but above all an opportunity to develop competitiveness at the microeconomic level.

Circular Economy

In 2021, Bulgaria lags significantly behind the EU average levels in terms of eco-innovation funds invested, eco-innovation activities, eco-innovation results achieved, resource efficiency results and socio-economic results.

Company managers have varying degrees of sensitivity and awareness of topics related to the circular economy and green products and services. For all-digital companies, these topics sometimes remain in countries because they initially consider themselves to be green. At the same time, for many manufacturing enterprises, topics related to green products and services are new and pose additional challenges to their adaptation and access to international markets.

A large number of enterprises have not yet started to implement practices in their activities that would make them part of the circular economy. However, a significant share of companies have implemented environmental standards (26.5%), use environmentally friendly materials and raw materials in their production processes (38.6%) and recycle waste (18.3%). The main reasons for the implementation of environmental standards and the use of environmental materials and raw materials are the requirements of the customers and the accepted standards of the respective markets.

It is a positive fact that 92.1% of enterprises do not encounter problems in the implementation of the regulations related to the classification, collection and treatment of waste.

Bulgarian enterprises are engaged in the production of green products and services in extremely rare cases. Enterprises that offer "green products" are only 9%, and just over 10% are those that plan to develop and market such products in the future. Accordingly, 91.0% do not offer green products, and 89.6% do not plan to do so. One reason is that the costs of creating green products are usually higher than the markets' perceived value of those products.

The main characteristics of enterprises in Bulgaria offering green products or services show that: 53% have not implemented environmental standards, 41% use green energy, 43% recycle waste, 73% use ecological materials and raw materials, 65% have a resource efficiency policy, 76% have an energy efficiency policy, 90% use environmentally friendly machines and cars, 82% have no problems meeting waste treatment regulations, 30% have implemented green digitization solutions, 55% have identified work processes to digitize, 58% expect environmental footprint to be reduced, 37% have prepared their buildings for smart management, 76% have invested in new technologies in the last five years, 26% have their own research and development unit, 36% can finance their innovation activity .

In general, the awareness of various aspects of the circular economy and green products in individual industries is weak and it is necessary to popularize the possibilities of providing green products and services.

Digitization and Environmentalization of Processes

The implementation of green digital solutions is also not sufficiently widespread among Bulgarian enterprises.

A large proportion of enterprises declare that the machines and cars they use meet modern environmental standards (73.1%) and this is definitely one of the most common "green" measures that enterprises have taken as part of implementing a greener approach on work.

The first steps to ensure green digitization are related to the identification of work processes that could be successfully and efficiently digitized. Nevertheless, the majority of enterprises do not think that digitalization would reduce the ecological footprint of their work (70.1%). Enterprises that are positive about the effect of green digitalization are 29.9%. Now, 10.3% of enterprises have implemented solutions related to green digitization in their work process, and 35.2% are at a stage where they have identified certain work processes whose digitization is possible.

Just over a quarter of medium-sized and small enterprises in the country have implemented environmental standards for work, and the implementation of environmental standards in the production process is essential for improving their environmental efficiency. The share of enterprises that use ecological materials and raw materials is significantly higher - nearly 40%, and just over 18% are enterprises whose production is also related to waste recycling.

The use of energy from renewable sources is another important part of production due to its environmental benefits, but enterprises in the country rarely use green energy in their production process. The enterprises that currently work with this type of energy are 11%, and these are more often companies from the processing industry.

The optimization of the production process is directly related to the provision of efficiency policies. For this reason, it is important to distinguish the share of enterprises in the country that have developed policies for resource and energy efficiency in their work - 34.6% are the enterprises that have developed policies for resource efficiency, and those with policies for both resource efficiency and energy efficiency is about 30%. Enterprises that have implemented resource efficiency policies very often already have energy efficiency policies in place. However, on the other hand, enterprises that have already introduced policies for energy efficiency, relatively less often have policies for resource efficiency as well.

Enterprises that believe that the partial or complete digitization of certain processes will affect the environmental footprint of their operations often have energy efficiency policies in place. Just over half of these enterprises also have implemented environmental standards, a resource efficiency policy and have identified work processes that could be digitized. However, most enterprises that declare that the partial or complete digitalization of certain processes will reduce the environmental footprint of their activity do not use green energy (79%) in the production process, do not offer green products (82.6%), do not plan to launch such on the market (78.3%) and have not implemented solutions related to green digitalization (70.2%).

Regarding the buildings that are prepared for the implementation of intelligent management, nearly 22% of the enterprises in the country have such.

Most companies in the country do not implement practices related to reducing the ecological footprint of production activities, green digitalization and green energy. To the extent that they are implemented, they are in the form of adopting decisions to reduce energy costs and increase resource efficiency, recycling waste from the enterprise's activities, as well as management decisions related to reducing the volume of waste from the company's activities. Although the topic of green digital solutions remains in the background among enterprises, nearly 20% have drawn up a digitalization and digital transformation plan in the last year.

In general, the majority of business organizations have little knowledge of the topic related to carbon footprint and do not have the sensitivity to analyze or measure the impact of their activity on carbon emissions. Among the main incentives that effectively affect the digitalization of processes related to the ecological footprint is the amount of energy costs, which make companies look for solutions in the direction of their reduction and introduce energy efficiency measures. Incentives can also be the centralized policies of the parent companies, which should be adopted and followed at the local level, market pressure from competitors, standards and requirements at the national and European level.

Information and Communication Technologies

Building a sustainable future is unthinkable without a green business transformation, while at the same time digitalization is increasing its importance for the success of enterprises. Optimizing the use of resources in order to achieve zero net emissions is directly related to digitalization of work processes.

In the last few years, two additional factors have played a positive role in accelerating digitization and the use of computer technology. First of all, it is Covid-19. The pandemic led to the rapid digitization of many spheres and processes, the transition to remote and paperless offices, etc. Secondly, high fuel prices, especially in the last year, lead to many hybrid solutions, for example hybrid forms of work, which lead to fewer transport services and trips, and therefore, to a lower carbon footprint.

More than half of the interviewed representatives of companies indicate that, of the possibilities offered for business digitalization, they mostly use the electronic signature of managers (55.6% to a large extent and 18.8% to a moderate extent) and internet / mobile banking (54.5% to a great extent and 21.8% to a moderate extent).

Among the representatives of enterprises in the country, the use of online payments through services such as epay, paypal and others, offering remote work for employees and opportunities for online orders and sales of products and services are not yet sufficiently widespread. Companies with more than 250 employees mainly use the mentioned types of digital applications in business, while companies with fewer employees need to take additional actions in these directions.

37.7% do not have corporate profiles on social networks, and another 47.6% of the companies do not use cloud services. In turn, the use of cloud services for storage, computing power and others is comparatively more pressing in organizations with more employed staff in order to facilitate the dissemination of information flow among all stakeholders, while in most of the smaller scale companies interviewed the integration of such a service is not recognized as a critical need.

Regarding the use of automated systems for managing administrative and business processes to the highest degree, enterprises in the country indicate that they work with accounting systems (36.2% to

a large extent and 21.8% to a moderate extent), systems for protecting information by means of encryption, archive and firewall management (24.4% strongly and 21.9% moderately) and warehouse, product and inventory management systems (24.4% strongly and 14.0% moderately).

According to the collected information, enterprises in Bulgaria prefer to invest funds in the implementation of separate specialized systems for managing their specific activities and needs, rather than using a single ERP system, which would potentially cost more or would not be fully compatible with their needs. The use of similar tools for managing individual processes is widespread again mainly among organizations with a larger number of personnel.

Just over a quarter of the companies have implemented specialized software solutions to support the production process (26.2%). The most common software products among companies that indicate that they use similar solutions in their operations are accounting software (20.4%). Next comes specialized engineering design software (16.3%) and software for administrative and business process management, better known as ERP systems (14.3%).

Engineering software is used by companies in the field of construction, production and distribution of electrical and thermal energy, professional activities and scientific research. Specialized accounting software and ERP systems for managing administrative and business processes have a wider scope and have been successfully integrated into organizations from various industries such as trade, transport, hotel and restaurant, creation and distribution of information and creative products, financial and insurance activities, professional activities and research and administrative and support activities.

In general, the degree of digitization in Bulgaria can be assessed as lagging behind most EU member countries.

Also, digital technologies that deal with online sales and customer payments are very unpopular - possibly because of the desire in some cases to avoid having information that would reveal the full amount of revenue, but also because of the more conservative behavior of a large part of consumers towards the use of online tools for purchases and payments. It should also take into account the still significant share of the so-called shadow economy (about 18% by mid-2022 according to NSI data), where the application of online sales is deliberately avoided, so as not to create opportunities for revealing practices in which the taxes due are "saved".

Even more alarming is the situation with the use of specialized software in enterprise management (as a whole or for individual management functions and activities). An explanation of the low level of use of such software solutions can be sought in two directions. First, in the small scale of the activities that can be facilitated with such software. Secondly, in the insufficient preparation of managers for the use of such software.

Environmental Footprint of Digital Technologies

The assessment of the environmental footprint of digital technologies was made in the following sectors:

- Manufacturing industry: Food production and Clothing production;
- Hospitality and restaurant industry: Restaurant industry
- Creation and dissemination of information and creative products, telecommunications (ICT): Information services.

Almost two-thirds of the surveyed enterprises (62.9%) have not implemented and do not intend to implement green digitalization. A small part (14.3%) have already realized one in recent years, and the rest (22.9%) are planning one in the near future.

The main conclusion of the research is that the enterprises that implement green solutions are characterized by higher energy costs than the others - in practice, it is not so much the share of energy costs in the total costs and the cost of production that matters, as the levels of costs for electricity and natural gas in particular.

Decisions in the direction of green digitization are taken into account by these enterprises with the aim of seeking a positive business effect, expanding the application of information technologies, optimizing processes, economical use of lighting and heating resources, accumulating data (to improve the management of business), achieving cooperation with partners (which require compliance with high environmental standards).

Enterprises that have already successfully implemented such solutions state that the benefits are mostly reduced to cost reduction, reduction in production cost and higher consumer value of products (competitive goods and services), time saving, and overall positive change in the enterprise. However, many of the entrepreneurs do not have the practice to collect and analyze, and accordingly, do not have the information about the amount of their energy costs and in particular about the cost savings because of digitalization and implementation of green solutions. This suggests that the pricing policy and cost optimization in most enterprises does not follow a precise quantitative analysis and search for the most effective possible solutions to reduce costs and the price of production. The low levels of awareness and application of green solutions in the business activities of Bulgarian enterprises also validate these findings.

A comparison was made between two groups of enterprises - those that implemented digital solutions with an effect on the ecological footprint, and those that did not. This effect represents an indicative estimate of the net contribution of digital transformation to reducing the digital footprint. The net effect of green digitalization amounts to 37% lower energy costs, showing that green digitalization has a tangible, quantitative impact on the financial performance of enterprises.

Taking into account the average energy consumption in selected enterprises, an indicative estimate of the energy savings can be made, which directly reflects the ecological footprint. The indicative assessment of the saved energy costs in the selected sectors of the processing industry shows that the enterprises that have implemented green digitalization have saved over BGN 70 million, in the restaurant sector the saved costs are over BGN 25 million, and in the of information services – over BGN 3.3 million.

The potential ecological footprint can be tracked based on the enterprises that have implemented digital solutions with a significant ecological footprint on the one hand, and those that intend to implement such on the other hand. The realization of the intentions and plans for green digitization would result in a net effect corresponding to over 285 million saved energy costs. The assessment of the effect of digital transformation in companies that have a high potential for such on the reduction of their energy consumption in the medium term (5-year plan) in terms of saved energy costs shows that the savings have the potential to reach BGN 1.4 billion.

Factors for successful Green Digitalization

Successful digitalization is influenced by a variety of factors that span technological, organizational, and cultural dimensions. Here are some key factors that contribute to the success of digitalization initiatives:

1. **Clear Strategy and Vision:**

- *Clear Objectives:* Define specific, measurable, achievable, relevant, and time-bound (SMART) objectives for digitalization.
- *Visionary Leadership:* Strong leadership that understands the value of digital transformation and can communicate a compelling vision for the future.

2. **Technology Infrastructure:**

- *Robust IT Infrastructure:* Ensure a solid foundation of hardware, software, and network capabilities to support digital initiatives.
- *Scalability:* Build systems that can scale to accommodate growth and changing demands.

3. **Data Management:**

- *Data Governance:* Establish data governance practices to ensure data quality, security, and compliance.
- *Data Integration:* Integrate data from various sources for comprehensive insights.
- *Analytics and Business Intelligence:* Implement tools for data analysis to derive meaningful insights.

4. **Agile Culture and Processes:**

- *Agile Methodologies:* Adopt agile practices to enable iterative development, quick adaptation to changes, and collaboration.
- *Cultural Change:* Foster a culture that embraces innovation, learning, and adaptation to change.

5. **Talent and Skills:**

- *Digital Skills:* Ensure that the workforce has the necessary digital skills and capabilities.
- *Continuous Learning:* Encourage a culture of continuous learning to keep up with technological advancements.

6. **Customer-Centric Approach:**

- *User Experience:* Prioritize user experience in the design and implementation of digital solutions.
- *Customer Feedback:* Continuously gather and incorporate customer feedback to improve digital offerings.

7. **Cybersecurity:**

- *Security Measures:* Implement robust cybersecurity measures to protect digital assets and sensitive information.
- *Compliance:* Ensure compliance with relevant regulations and standards.

8. **Collaboration and Partnerships:**

- *Ecosystem Engagement:* Collaborate with partners, suppliers, and other stakeholders in the digital ecosystem.
- *Open Innovation:* Explore opportunities for innovation through collaboration with external entities.

9. **Change Management:**

- *Communication:* Communicate the benefits of digitalization to all stakeholders.

- *Change Leadership*: Provide leadership that facilitates and supports the change process.

10. Scalable and Modular Architecture:

- *Modularity*: Design systems with modular components for easier integration and updates.
- *Scalability*: Ensure that digital solutions can scale to meet future demands.

11. Risk Management:

- *Risk Assessment*: Identify and manage potential risks associated with digitalization projects.
- *Contingency Planning*: Develop contingency plans for potential disruptions.

12. Regulatory Compliance:

Adherence to Regulations: Ensure compliance with legal and regulatory requirements relevant to digital initiatives.

Success in digitalization often requires a holistic and integrated approach, considering the interplay of these factors. Flexibility, adaptability, and a willingness to learn from both successes and failures are crucial for sustained success in the rapidly evolving digital landscape.

Factors related to green digitalization are divided into two types: endogenous (internal environment) and exogenous (external environment). They can both stimulate the implementation of green digitalization and act as a deterrent to its implementation.

1. Endogenous factors (internal environment) that stimulate or hinder the implementation of green digitalization measures at enterprise level

Research on the processes of digitization and the ongoing digital transition, on the one hand, with a focus on concepts such as digitization, innovation, digital transformation, etc. and the so-called "green" activities to improve environmental performance, on the other hand, with a focus on circular economy, environmental measures, eco-innovation, energy efficiency, carbon footprint, etc. individually, they demonstrate considerable diversity across national, local and sectoral parameters, respectively, and are subject to multiple disciplines. The topic of the double transition and "green digitalization" in the context of Bulgarian enterprises is, however, relatively new, thus far limiting the number of studies or case studies documenting the drivers or obstacles to the organizations' use of green digitalization measures in implementing the above concepts. Available studies often distinguish between structural barriers involving organizational factors (lack of strategy, human resources, digital skills, management capacity, etc.), technological barriers (technical infrastructure, lack of interoperability, access to data, etc.), or resource deficits (limited budgets, access to finance, etc.), and cultural barriers related to perceptions, norms and expectations (vision, management commitment and leadership, competing priorities, resistance to change and established 'ways of doing things', avoidance of risk, etc.).

Endogenous factors can be considered in two aspects: organizational culture for green digitalization and technology adoption, and factors that stimulate or hinder the implementation of green digitalization measures at the enterprise level in individual economic sectors and activities.

1.1. Organizational culture for green digitization and technology adoption

The first aspect has several elements:

1.1.1. Organizational culture for green digitization and technology adoption

Activating or stimulating factors:

- A green digitization culture is based on experience and knowledge and is formed by data from multiple sources shared in a management framework open to the **twin transition** that enables change and continuous process improvement.
- Adopting technology as a means to improve organizational processes and environmental impact is a determining factor for successful green-digital solutions. A data-driven innovation culture is essential to successful Big Data initiatives. Aimed at improving environmental performance, organizational thinking provides a basis for understanding and supporting green digitalization measures, as their added value to demand improvement is understood..
- A sustainability and ESG-oriented culture enables organizations to plan their development in a balanced, holistic way, perceiving how the individual parameters: environmental, social and management, and technological aspects interact with each other and how they can be used to create more and sustainable added value both for the company itself in particular and for society as a whole.

Barriers or inhibiting factors

- Deficits in the culture regarding green digitalization are a powerful restraining factor directly affecting all phases of management processes related to the double transition (green and digital): planning, implementation, verification and improvement. Addressing them effectively requires a long-term vision, organizational focus, sustainable measures and continuous effort and correspondingly supportive and directional high commitment from owners and management.
- Stubborn adherence to the established status quo, institutional habits and "ways of doing things" create psychological barriers that make both the planning and the subsequent implementation of green digitalization measures difficult. The fear of moving away from paper-based management, the lack of a built culture of digitization create obstacles to the use of digital technologies. The treatment of environmental risks as an "exotic" matter, not directly related to the processes in the organization, prevents seeing the possibilities of green digitization measures in full, and their understanding and integration in an appropriate way in the policies and activities of the company. In the absence of the sustainability dimension in the organizational culture, even successfully implemented measures can hardly become a "way of thinking" and "organizational practice".

Activating or stimulating factors:

- Semantic search technologies transform knowledge in the network, digitizing, personalizing, and transferring organizational knowledge and know-how to employees as appropriate. AI-based knowledge systems lead to new opportunities.

Barriers or inhibiting factors:

- Low awareness and associated low levels of knowledge about green digitization and the specific added value associated with the implementation of relevant measures are active cultural constraints that directly affect the development of strategies on the subject and prioritize it within the organization. Insufficient knowledge of the potential benefits of digital transformation at the relevant management levels hinders the process at both the planning stage and the subsequent stages of the management cycle. Low awareness of the various aspects of environmental performance management makes it difficult to adapt foreign experiences to one's own environment in order to achieve one's own goals.

- In the absence of past experience in implementing measures for both digitization and ecological purposes, there is a registered uncertainty about the added value associated with the implementation of similar projects, acting as a inhibiting psychological barrier.

1.1.2. Organizational vision and strategy, Management know-how and sponsorship of change. Ownership of processes. Business growth or scaling opportunities

Activating or stimulating factors:

- The organizational vision in the two areas of the dual transition, namely ecology and digitization, sets the foundation for appropriate strategies and tactics and allows the vision to integrate successfully into organizational goals, identifying opportunities for business growth or scaling.
- Where there is vision, organizations can recognize the challenges associated with the development of new technologies and, after assessing and communicating them, develop appropriate strategies and tactics to "capture" the best of them. In contrast to organizations where this vision is absent and where challenges are primarily perceived as threats.
- Management vision in the areas of the dual transition is a "necessary condition" for the management cycle related to measures for green digitization: planning, execution, measurement, and evaluation of progress. It provides the necessary strategic direction to drive progress in operational processes.
- Clear allocation and communication of roles and responsibilities related to measures allow the respective leaders or employees to act as "true" owners of the change processes.

1.1.1. Knowledge and awareness of digitization and digital transition, awareness of the circular economy and green products and services. Experience with measures for green digitization

Activating or stimulating factors:

- Semantic search technologies are transforming knowledge on the web, with the organizational knowledge and know-how of enterprises being digitized, personalized and transferred to employees as appropriate. Artificial intelligence-based knowledge systems lead to new possibilities.

Barriers or inhibiting factors:

- The low level of awareness and the associated lack of knowledge regarding green digitization and the specific added value linked to the implementation of relevant measures are active cultural constraints that directly impact the development of strategies on the subject and its prioritization within the organization. Insufficient understanding of the potential benefits of digital transformation at the relevant management levels hinders the process both at the planning stage and in the subsequent stages of the management cycle. Low awareness of the various aspects of environmental performance management complicates the adaptation of foreign experiences to the local context with the aim of achieving the organization's own goals.
- In the absence of past experience in implementing measures for both digitization and ecological goals, there is a noted uncertainty in the added value associated with the implementation of similar projects, acting as an inhibiting psychological barrier.

1.1.2. Organizational vision and strategy, Management "know-how" and "sponsorship" of change. Process ownership. Opportunities to grow or scale the business

Activating or stimulating factors:

- The organizational vision in both areas of the dual transition, namely ecology and digitization, establishes the foundation for appropriate strategies and tactics, enabling the vision to seamlessly integrate with organizational goals. This includes identifying opportunities for business expansion or scaling.
 - Where there is a vision, organizations are adept at recognizing challenges associated with the development of new technologies. After evaluating and communicating these challenges, they develop suitable strategies and tactics to harness the best outcomes. In contrast, organizations lacking such a vision tend to perceive challenges primarily as threats.
 - Managerial vision in the realms of the dual transition is a "necessary condition" for the management cycle associated with green digitization measures: planning, execution, measurement, and progress evaluation. It provides the essential strategic direction to propel progress in operational processes.
 - Clear allocation and communication of roles and responsibilities related to the measures enable respective leaders or employees to act as "true" owners of the change processes.

Barriers or inhibiting factors:

- The lack of a long-term vision is a crucial cultural barrier, as it prevents the integration of the overall concept of green digitization into organizational goals. In the absence of a vision for the added value of green digitization to the organization's performance, even well-executed measures would only have episodic significance, failing to effectively contribute to the value creation process.
 - Digital transformation requires a new way of thinking, a new business model, a new approach to process management, customer relationships, workforce interactions, and automated optimization of operations. The absence of such thinking, or associated deficits, especially at the business owners' and top management levels, acts as strong inhibiting factors.
 - In organizations where there are no clearly defined mandates related to green digitization measures, the processes of planning, execution, monitoring, and improvement of these measures are seriously impacted by the lack of clearly defined, delegated, and communicated roles, authorities, and responsibilities. Unclear mandates and the lack of ownership over processes related to green digitization measures slow down progress on various initiatives.

1.1.3. Workload and competing priorities

Barriers or inhibiting factors:

- The workload, problems and challenges faced by enterprises actively prevent green digitalization from becoming a current priority.

1.1.4. Change Management

Activating or stimulating factors:

- Digital culture requires leadership competence for change at all levels of the organization. The transformed processes necessitate vision, skills, and commitment at all levels.

Barriers or inhibiting factors:

- Digital transformation changes processes, roles, and expectations and can cause corporate chaos before becoming operational. This is where the fear of job loss comes into play. Therefore, change should be implemented gradually, involving stakeholders, clearly formulating and communicating the benefits, and maintaining open dialogue. The inability to manage changes adequately is an active barrier, especially in the implementation phase of green digitization measures.

1.1.5. Управление на риска

Activating or stimulating factors:

- Risk management is established as a key factor for the successful adaptation of the organization to the dynamics of the context's development and the requirements of stakeholders, addressing both threats and emerging opportunities adequately.

Barriers or inhibiting factors:

- Without effective risk management, enterprises practically fail to manage vulnerabilities or tap into the potential for development in the areas of dual transition adequately.

1.1.6. Decision making and flexibility

Barriers or inhibiting factors:

- The traditional focus on manual and labor-intensive activities limits the company's thinking. Conversely, topics such as comprehensive automation, big data, artificial intelligence, and closed-loop systems allow managers and employees to focus on abstract and complex solutions.

- Flexibility not only refers to the speed at which companies embrace ideas for green digitization measures and embark on changes, but also to the effective use of available resources to adopt a suitable adaptive response to transformations and maximize the benefits of the discovered new opportunities.

Barriers or inhibiting factors:

- In organizations where the decision-making system lacks the necessary flexibility and effective mechanisms for integrating experience, "lessons learned", and the results of observation, measurement, and process evaluation into improvement processes, progress is achieved with great difficulty. Here, there is a serious risk that planned and implemented projects or measures may yield an "isolated" effect without being successfully integrated into the organization's "sustainable thinking and attitudes".

1.1.7. Business Process Management and Identification of Green Digitization Potential. Potential for Product or Service Virtualization and Value Chain Reorganization

Activating or stimulating factors:

- A digital organization can quickly adapt processes to take advantage of emerging technologies. Business processes, management, and mapping of the workflow at all levels need to be understood.

- Identifying the potential for virtualizing products or services and reorganizing the value chain is a key prerequisite for the successful planning and implementation of green digitization measures.

Barriers or inhibiting factors:

- The lack of readiness to improve processes effectively hinders the planning of green digitization measures.

- Without a deep understanding of business processes and the ability to identify their potential for green digitization, organizations cannot accelerate their digital transformation process nor fully reap its benefits.

1.1.8. Innovations

Activating or stimulating factors:

- Innovation is a driver for better market performance and the competitiveness of enterprises, associated with the introduction of new products, entering new markets, and the unique positioning of a product or service.

Barriers or inhibiting factors:

- The lack of innovative activity puts enterprises in a "catch-up" mode with successful market players, diminishing competitiveness.

- Where new technologies are not monitored, and there is no exploration and adoption of new approaches or solutions, the organization remains somewhat "out of touch" with the times and loses.

1.1.9. Technologies (technological infrastructure and equipment) and technological resources)

Activating or stimulating factors:

- Technological readiness through appropriate technologies and technological resources provides the necessary foundation for the successful planning, implementation, and improvement of green digitization measures by Bulgarian companies.

Barriers or inhibiting factors:

- Insufficient maturity of the technologies used and uncertainty about future technological developments pose a major obstacle to future digitization. Without adequate infrastructure, the deployment of new technologies cannot occur.

1.1.10. Data management and protection and information security

Activating or stimulating factors:

- Implementing a system of standards and norms to ensure the security of network and information resources at all stages of project implementation creates effective protection against vulnerabilities and data compromise. Data at all levels of the organization are treated as a strategic asset. The relevant personnel are competent to take on information management.

Barriers or inhibiting factors:

- Deficiencies in managerial and technical approaches to data management and information security compromise the vulnerability of green digitization management processes. Information security risks pose key obstacles to the successful execution of green digitization projects and compromise their effectiveness and sustainability.

1.1.11. Resources and Resource Management (Expenditure and Resource Organization Model, Investment Focus, Procurement). Intellectual Property

Activating or stimulating factors:

- Investment planning and continuous improvement are coordinated and collaborative as a unified organization with high productivity.
- Prospects for expected results, such as reducing the use of raw materials or other input resources and lowering operational costs, effectively stimulate the planning and implementation of green digitization measures.

Barriers or inhibiting factors:

- Without resources tailored to the needs and uncertainties about future technological developments and investments, businesses lack the resource capacity to address serious challenges stemming from the dynamics of adverse developments in the external political and economic environment. This includes resource shortages and the associated increase in the prices of these resources, as well as changes in the political landscape.

- The integration of digital technologies into the processes of creating and delivering products or services requires significant investments, which carry risks and uncertainties over time. There is a high share of non-recoverable costs for additional training and bringing the system into operational readiness, as well as in many cases a low potential for future changes and adjustments. In this regard, a balance and feasibility should be ensured to optimize the processes of automation, resources, and time..

1.1.12. Access to finance

Activating or stimulating factors:

- Access to adequate financial instruments at each stage of implementing digital transformation in enterprises, including training, is one of the crucial factors for the successful progression of the process.

Barriers or inhibiting factors:

- Limited access to financing or its absence (own capital), the level of indebtedness, as well as limited interest and insufficient familiarity with various financial instruments by companies effectively hinder the planning of green digitization measures, as well as the overall formation of attitudes towards transitioning to an environmentally sustainable digital culture.

1.1.13. Standards and regulatory framework (including protection of information security)

Activating or stimulating factors:

- Standardization is key to meeting objectives and implementing legislation, ensuring greater market access and technology deployment.

1.1.14. Управление на екологичните рискове и екологичен отпечатък

Activating or stimulating factors:

- Improving resource productivity can help minimize negative environmental impacts and reduce dependence on volatile raw material markets.
- Reducing the environmental footprint.

Barriers or inhibiting factors:

- Building a sustainable future is unthinkable without the green transformation of businesses. As part of the transition to optimizing resource use to achieve net-zero emissions, digitization of work processes is essential, both for large corporations and small and medium-sized enterprises.

1.1.15. Access to markets and internationalization

Activating or stimulating factors:

- Openness and international collaboration are crucial drivers for promoting innovation and technological development. They serve as an effective channel for influencing the supply chain, which is a significant activator for the transfer of best practices in green digitization.

1.1.16. Stakeholder Engagement and Consumer Demand. Effective Partnerships. Consumer Demand and Attitudes as Drivers for Green Digitization Development

Activating or stimulating factors:

- Consultation and active communication with stakeholders amplify the opportunities for effective planning, execution, monitoring, and improvement of measures for green digitization. Suitable partnerships support resource provisioning and provide a stimulus for exchanging best practices as well as developing innovative ideas.

Barriers or inhibiting factors:

- Ineffective communication and consultation processes with stakeholders deprive the organization of the unique opportunity to generate new ideas, assimilate foreign experiences, and facilitate the planning, implementation, and improvement processes of measures for green digitization with additional partner resources.

- The lack of commitment and exploration of consumer opinions prevent the organization from orienting itself to the possibilities of the context and addressing them adequately to generate positive results.

Consumer demand and attitudes as a driver for the development of green digitalization

- Factors related to the products themselves: price, quality, functional features, availability.
- Another key set of motivations that guide their environmentally friendly behavior in purchasing is the increasing concern of consumers about environmental and social issues.

- Related to environmental concern, important factors influencing the intention and behavior of environmentally friendly purchasing are the relevant information and knowledge on the part of the consumer.

- Perceived consumer effectiveness or the potential to "make a difference" are other important factors, the essence of which is expressed in how much consumers believe that by choosing a specific green product, they actually have a real impact on solving the overall problem.

- The emotional appeal of the "green choice" or, more specifically, environmental concern, has a positive and direct impact on the intention and behavior of consumers for environmentally friendly purchases.

- Conversely, adherence to the status quo, habits, and automated choices are shaped as inhibiting factors when purchasing green products.

- Brand image is another important factor influencing the purchase of green products.

- Consumer trust (belief or expectation) in the green brand is an important motivational criterion for the purchase of green products.

- Factors playing the role of a stimulus to consumer trust are respectively eco-labeling and certification.

1.1.17. Measurements/KPI

Activating or stimulating factors:

- Capturing information or indicators is of utmost importance for the overall process of planning, implementation, and evaluation of measures for green digitization. Improving business requires the ability to interpret, measure, and prioritize business processes and efficiency.

- Monitoring and tracking provide real-time information and can be catalysts for the development of the circular economy. The implementation of green digitization measures can lead to improvements in performance in terms of indicators such as sales and overall customer satisfaction, as well as the enhancement of products or services..

Barriers or inhibiting factors:

- Ineffective processes of monitoring, measuring, analysis, and evaluation do not allow the organization to provide the data and perform the analysis that form the "backbone" of the dual transition.

- The lack of measurement and analysis blocks the path of organizational learning and informed improvement. There is no opportunity to implement corrective actions since reliable information about the state of processes and products is absent.

1.2. Analysis of factors (internal environment) that stimulate or hinder the implementation of measures for green digitization at the enterprise level in individual economic sectors and activities

1.2.1. Organizational culture for green digitalization

- Organizational culture as a factor for the adoption and implementation of measures in the areas of dual transition: digitization and ecology is undoubtedly among the most important motivators or barriers, and at the same time, one of the most challenging to address.

- Depending on the sensitivity and organizational culture of Bulgarian enterprises in the areas of dual transition: digitization and ecology, where attitudes favor green innovations and digitization, measures for green digitization find their natural "sponsor." In cases where a culture suitable for the time of technologies and green challenges is lacking, organizations face the enormous challenge of shaping it, primarily through demonstrated commitment, clear goals, and personal example from top management.

1.2.2. Knowledge and awareness of twin transition. Experience with green digitization measures

- The difficulties are related to the supply chain and their integration into the processes of the digital economy, including a lack of awareness about high-tech solutions and the potential benefits of their application in manufacturing processes.

- Identified deficits in awareness regarding the circular economy, green products and services, and the value that green digitization can add to corporate performance, including environmentally, act as effective barriers hindering the adoption of green digitization measures. Overall, awareness of various aspects of the circular economy and green products in individual industries is considered insufficient, and there is a recognized need for expanded, in-depth, and systematically conducted informational and consultative formats on how individual businesses could start providing green products and services, what the best practices are, and what potential added value exists.

- The varying degrees of sensitivity and awareness of topics related to the circular economy and green products and services depend on the sector, the scale of activity, and the size of expenses that can be optimized through investments in digitization, as well as experience with the implementation of environmental standards.

- The growing relevance of ESG (Environmental, Social, and Governance) issues and the mandatory reporting and subsequent verification of sustainability in the non-financial performance of companies, covering environmental, social, and corporate governance aspects, have become increasingly important. While these topics currently mainly concern large international companies, if appropriately addressed, they could become activators of processes for implementing measures for green digitization.

- There is a recognized need for information campaigns to systematically address the areas of dual transition, demonstrating the significant connection and mutual dependence between the components of digitization and green provisioning. Currently, this integrated "communication" is episodic, and as such, it does not encourage an integrated approach and thinking toward the dual transition..

1.2.3. Human capital. Competence and skills (technical, environmental, project management)

- The human capital required for the successful planning, implementation, and improvement of measures for green digitization in Bulgarian enterprises is in a process of development. The dynamics of this development clearly demonstrate the potential of the researched sectors, primarily the processing industry and information and communication technologies, to set a leading example for other sectors. However, achieving the desired results requires appropriate human resource recruitment policies, the development of these resources, and their retention in enterprises through a targeted and results-oriented motivation policy. Adequate talent management and the proper recognition of their added value in the processes of the company's organizational performance are key drivers of success. Conversely, any deficits in these processes act as a hindrance and become a

primary barrier to creativity, innovation, motivation, and engagement, which are necessary conditions for the effective implementation of measures in the areas of the dual transition.

1.2.4. Leadership, vision and strategy for green digitization

- Management vision and strategy are powerful factors that inspire, guide, and motivate development processes in Bulgarian enterprises, including those related to the dual transition. They form the foundation of strategic planning processes within organizations, and their deficiencies act as barriers to planning measures for green digitization.

- The vision and strategy in the digital transition are more pronounced among the participants in the study. There is a wide spectrum of differences between predominantly digital businesses focused on integrating digital technologies to transform the way the entire business operates and less developed companies seeking digital technologies to address specific business problems. Overall, the scale of activity and the associated expenditure directly influence companies' propensity to take measures for process optimization and digitization.

- Policies related to resource management with a focus on energy efficiency have the first position in this regard.

- The study identified the following stimulating factors influencing decisions towards green digitization: a strong economic component of green investments (resource savings and more economical production or cost reduction), a robust business component (positive business effects, process optimization, data accumulation for improved business management, compliance with partner requirements regarding the use of ecological standards, better access to participation in public procurement when ecological requirements are defined), and a significantly less pronounced ecological, green component. It is precisely this less emphasized ecological motivation that leads experts to believe that sustainability goals are still somewhat outside the main focus of management vision and strategy. On the other hand, there is already experience from successfully implementing green solutions, with benefits primarily manifesting as cost reduction, lower production costs, higher consumer value of products (more competitive goods and services), time savings, and an overall positive transformation within the enterprise.

- The deficits in management vision and strategy are closely linked to insufficient motivation, which emerges as a significant barrier to the green transformation of enterprises. Given the primary goal of enterprises to achieve high financial results, investments in environmental conservation, often of considerable scale, are perceived as less attractive. This is because it is believed that such investments may displace or reduce productive investments, thereby demotivating investment in environmental conservation. Attitudes and arguments that encourage measures for green digitization to be used as a counterbalance to established barriers include environmental oversight, mandatory reporting of non-financial performance parameters of enterprise activities, particularly sustainability, disclosure of social responsibility, policies to incentivize energy-efficient consumption, and tax policies designed to stimulate the green transformation of enterprises.

1.2.5. Workload and Competing Priorities

- An active barrier to the planning and implementation of green digitization measures is precisely the workload of enterprises to cope with the economic challenges of the environment, which imposes an order of priorities with a main focus on economic performance, whose paradigm is often "survival" itself.

- Turning green digitalization into an actual priority requires qualitative and quantitative changes in the attitudes, awareness, competence and vision of the management at the level of an individual enterprise, as well as sectoral support from industry organizations and institutional support.

1.2.6. Risk management and change management

- Ineffective risk management and change management processes are key barriers to the successful planning, execution, and improvement of green digitization measures.
- Significant activation of these processes comes from standardization, serving as a tool to enhance risk management, including ecological risk, and promoting continuous improvement through digitization and business process optimization.
- Trends show an increasing influence of standards towards more effective risk management, with the manufacturing sector leading in good practices. These practices are primarily influenced by international partner requirements, participation in supply chains for major companies and trade networks, transfer of foreign experience in management, participation in public procurement tenders, exposure to stronger external competition in the development of new products and services, and decision-making related to reducing production costs, more extensive research and development activities, and investments in scientific and technological activities. These good practices should be replicated, deepened, and expanded.

1.2.7. Decision-making and flexibility

- There is a high degree of autonomy in decision-making processes by the management team in the areas of innovation and investments. This level of autonomy is a positive factor that could facilitate the implementation of measures for green digitization, given other favorable environmental factors—primarily awareness, vision, and strategy, appropriately integrating the theme of green digitization into strategic and business processes.

1.2.8. Business process management, digitization and identification of potential for green digitization

- Management of business processes in enterprises is an important factor for the planning and implementation of measures for green digitization.

1.2.9. Innovations. Encouraging eco-innovation

- Innovation emerges as a key factor for the competitiveness of enterprises and for the successful implementation of measures for green digitization.
- The lack of adequate resource provision for developmental processes is an active constraint.
- A factor with direct significance for innovation activity is the corresponding competency of the human resource.

1.2.10. Technologies (technological infrastructure and equipment) and technological resources

- A key restraining factor for Bulgarian enterprises in the direction of green and digital transformation is the insufficient maturity of the technologies and technological resources used.
- The impact of the Covid-19 pandemic and the increase in fuel prices are indicated as factors that have activated the processes of digitization and use of ICT in recent years. Uncertainty about the return on investment affecting the technological future, the rapid development of technology challenging the allocation of limited resources, deficits related to the competence of personnel and the cost of specialized accompanying training are identified as constraining factors.

1.2.11. Data management and information security governance

- The low levels of systematic management and protection of data and information security in Bulgarian companies emerge as an active barrier to the successful implementation of measures for green digitization.

1.2.12. Resources and resource management. Intellectual property

- A key hindering factor for the overall policies of Bulgarian companies in the direction of green and digital transformation is the lack of resources tailored to their needs and uncertainty about future technological development and investments.

- Difficulties in accessing financing, relatively low levels of innovation activity, deficits related to human capital, and the necessary competencies and skills for the dual transition and levels of digitization or ICT are outlined as hindering factors in resource provisioning. These deficits play a particularly strong inhibitory role in start-up companies and at the stage of process optimization and business expansion, including entering international markets.

- Implemented standards provide an important stimulus towards effective resource utilization, as well as the use of eco-raw materials and recycling activities.

- A positive factor for the investment activity of companies is the freedom and operational autonomy to make investment decisions, confirmed as relatively high.

- The lack of sufficient financial resources for the registration of intellectual property rights is a hindering factor. This is particularly evident in start-up companies.

1.2.13. Access to Financing

- In conditions of resource constraints, access to financial resources is a key factor for undertaking measures for green digitization.

- An evaluating factor for access to financing is the structure of the sources used to fund activities.

- The constrained access to financing is largely a function of both the cost of financing and its technical accessibility.

- Monetary solvency and the level of indebtedness are also crucial factors in identifying attitudes toward the transition to an environmentally sustainable digital culture.

1.2.14. Standardization and Regulatory Framework

- Standardization as a tool for improving risk management, including environmental risk, and promoting continuous improvement, including through digitization and enhancement of business processes, is a factor whose significance for business is currently tangible, with clear trends of increasing influence.

1.2.15. Green Economy, Operational Environmental Management, and Ecological Risks

- A weakly expressed ecological, green component has been identified in enterprise management, indicating a lack of organizational maturity in various managerial and operational aspects related to the "green economy" theme. Green transformation processes are in the early stages of development, limited to a small number of enterprises.

1.2.16. Market Access and Internationalization

- The internationalization of businesses emerges as a crucial motivating factor for the competitiveness of Bulgarian enterprises, creating opportunities for the transfer of data, information, and best practices to explore new digital products and green solutions, know-how, and market entry strategies.

1.2.17. Engagement and Involvement of Stakeholders. Partnerships. Consumer Demand Research.

- The potential for involving stakeholders in enterprise development processes, including the direction of the dual transition, although significant, largely remains untapped by the surveyed enterprises. Existing good practices for planned management of these relationships are mainly observed in the field of ecology, significantly influenced by the requirements of international partners or supply chain impacts.

- While still at relatively low levels, there are promising data indicating interaction and collaboration between science and business in the direction of developmental activities and the exchange of best practices, especially in the ICT sector. This interaction should be replicated, deepened, and expanded with the participation and commitment of both parties.

1.2.18. Performance Evaluation/KPI Environmental Footprint

- The potential for performance assessment as a tool for development and planning, and the implementation of green digitization measures through appropriate monitoring, measurement, evaluation, and analysis processes by enterprises on various aspects of organizational performance, including environmental performance, although significant, largely remains untapped by the surveyed enterprises.

- The existing best practices currently have primarily an episodic nature, influenced mainly by the requirements of international partners, and should be replicated, deepened, and expanded.

The results of different researches show that systematic actions are needed both in the direction of increasing the relevant competence of the human resource and for improving the processes of monitoring, measurement, analysis and evaluation for the purposes of improvement in enterprises. Without adequate performance evaluation processes, there is no way to generate management information that will convince top management to plan green digitization measures and that will motivate staff to perform. Good practices in sectors such as ICT in this regard provide a promising application for the future.

2. Exogenous factors of the context (the external environment) that affect the implementation of measures for green digitalization by Bulgarian enterprises

2.1. Global factors

Among the global factors relevant to the twin transition are:

2.1.1. The COVID-19 pandemic is still affecting the global economy. The recovery from the pandemic has been described as "fragile", with many countries facing economic burdens due to high healthcare costs and crisis response investments. The pandemic is still causing local lockdowns that disrupt global supply chains and lead to shortages of products and components, affecting commodity markets, especially in countries with low purchasing power. At the same time, the pandemic stimulates adaptability by accelerating the development of digital technologies, leading to the rapid digitalization of many spheres and processes, the transition to remote and paperless offices, etc. and supports and facilitates rapid adaptation to new challenges. Shifting to remote and other hybrid work models significantly reduces the need to travel, with a positive effect on the carbon footprint.

2.1.2. Russia's military aggression against Ukraine has a strong impact on green and digital technology transitions, clearly outlining the importance of the geopolitical aspects of the transition to clean energy, emphasizing the need to accelerate it and to join efforts to achieve a more sustainable energy system and truly energy union. The global increase in food and energy prices, global risks to

food security, problems with energy independence and the safety of critical energy infrastructures, the realignment of available funding due to the investments made in defense, create parallel incentives or barriers for the dual transition.

2.1.3. Climate and environmental risks are at the center of global green digitalization drivers. As current crises divert resources away from medium- to long-term risks, the burden on natural ecosystems is projected to increase, with nature loss and climate change inextricably linked – failure in one area will grow into the other.

2.2. Challenges and opportunities at the level of the European Union

2.2.1. Challenges for the EU

Predicted processes and factors that will influence economic autonomy in the next decade are climate change and environmental degradation, digital hyper-connectivity and technological transformation, as well as pressures on democracy and values, and changes in world order and demographics.

2.2.2. EU policies in response to the challenges to promote the dual transition

The EC emphasizes the interconnectedness between the ecological and digital transitions by emphasizing their ability to reinforce each other. In this regard, the policies laid down in the European Green Deal, a cross-sectoral strategy to achieve climate neutrality and reduce environmental degradation by 2050, are key to the ecological transition. On the other hand, the digital transition should extend its scope to relation to sustainability in order to reduce adverse side effects and realize its full potential to achieve environmental, social and economic sustainability. This leads to relevant policies and governance presented in Digital Compass and Ready for Target 55.

2.2.3. Challenges and opportunities at the national level. National policies regarding the twin transition

2.2.3.1. Recovery and Sustainability Plan – Clear emphasis on the twin transition

2.2.3.2. The National Development Program "Bulgaria 2030" – Provides a strategic framework defining the vision and overall objectives of development policies in all sectors of government.

2.2.3.3. The coalition agreement of the government – Contains a section dedicated to the circular economy.

2.2.3.4. Strategy and action plan for the transition to a circular economy of the Republic of Bulgaria for the period 2021-2027 – The project is aimed at three strategic goals: 1) green and competitive economy; 2) less waste, more resources and 3) consumer-friendly economics.

2.2.3.5. National strategy for small and medium enterprises 2021-2027 – Priority "Environment" is among the six priorities of the strategy.

2.2.3.6. Innovation and Competitiveness Program 2021-2027 – In the context of the European Green Deal, the Circular Economy is among the three main priorities.

2.2.3.7. National Waste Management Plan, 2021-2028 – A key role in achieving sustainable waste management characterized by efficient use of resources.

2.2.3.8. Integrated Plan in the Field of Energy and Climate of the Republic of Bulgaria 2021-2030 – Includes the development of an integrated forecasting model in the field of energy and climate, as well as the formulation of a Long-Term Climate Strategy.

2.2.3.9. National Strategy for Adaptation to Climate Change and Action Plan until 2030 – Sets the framework for climate change adaptation (CCA) actions and priority directions until

2030, identifying and confirming the necessity of CCA actions for both the entire economy and at the sectoral level. The included sectors are: "Agriculture," "Biodiversity and Ecosystems", "Energy", "Forests", "Human Health", "Transport", "Tourism", "Urban Environment" and "Water". Disaster risk management is considered as a cross-sectoral theme.

2.2.3.10. Environment Program 2021-2027 – "Promoting the transition to a circular economy" is a specific objective.

2.2.3.11. Digital transformation of Bulgaria for the period 2020-2030– It defines the vision and objectives of the country's digital transformation policy until 2030, as a generalized political framework, among the National Program "Digital Bulgaria 2025", the "National Development Program BULGARIA 2030", and a number of other national strategic documents with a technological component.

2.2.3.12. Other national strategic documents

2.2.3.12.1. With ecological component

- *Environmentally Friendly Public Procurements:*

National Strategy for the Development of the Public Procurement Sector in Bulgaria: A national strategy outlining the development goals and actions for the public procurement sector in Bulgaria. This strategy likely includes measures to promote environmentally friendly public procurement practices. Additionally, there may be an associated Action Plan for the period 2014-2020.

Project: Strategy for Biodiversity in Bulgaria: A project focused on the strategy for biodiversity in Bulgaria. This may involve plans and actions to protect and enhance the country's biological diversity.

Strategic Plan for Biodiversity 2011-2020 "Natura 2000": A strategic plan addressing biodiversity for the period 2011-2020, particularly related to the "Natura 2000" network of protected areas in Europe. This plan likely includes measures to safeguard and manage biodiversity in Bulgaria in alignment with broader European conservation efforts.

- *Water:*

National Strategy for Management and Development of the Water Sector (NSMDWS) in the Republic of Bulgaria: An official document outlining the strategic goals and actions for the management and development of the water sector in the country. This strategy typically includes measures for preserving water resources, improving water infrastructure, and ensuring the sustainability of the water sector.

Strategic Action Plan for Environmental Conservation and Restoration of the Black Sea: A document defining strategic actions and goals for environmental conservation in the Black Sea region. Such a plan likely includes measures to combat pollution, preserve biodiversity, and restore ecosystems in the Black Sea.

River Basin Management Plans: Documents that outline strategies and actions for managing water resources in river basins. These plans usually include measures to prevent floods, preserve water ecosystems, and manage water resources.

Strategy for Environmental Conservation in the Maritime Waters of the Black Sea in the Republic of Bulgaria: A document outlining strategic goals and measures for conserving the marine environment in the Black Sea by the Republic of Bulgaria.

Flood Risk Management Plans: Documents that include strategies and measures for flood risk management. Such plans are aimed at preventing floods, managing water flows, and preparing for a rapid response in the event of natural disasters;

- *Air:* Национална програма за подобряване качеството на атмосферния въздух (2018 – 2024г.), Национална програма за контрол на замърсяването на въздуха (2020 - 2030г.);

National Program for Improving the Quality of Atmospheric Air (2018–2024): A comprehensive plan focused on enhancing the quality of the atmospheric air in a given country. The program, spanning

from 2018 to 2024, likely includes strategies, measures, and actions to monitor and mitigate air pollution, improve air quality standards, and promote sustainable practices.

National Program for Air Pollution Control (2020–2030): A strategic initiative addressing the control of air pollution at the national level. Covering the period from 2020 to 2030, this program likely outlines measures and policies aimed at reducing and preventing air pollution, setting emission standards, and promoting sustainable practices to ensure long-term improvements in air quality.

- *Soils:*

National Program for Conservation, Sustainable Use, and Restoration of Soil Functions (2020-2030)

National Action Program for Sustainable Land Management and Combating Desertification in the Republic of Bulgaria (Update for the Programming Period 2014-2020);

- *Climate:*

Long-term climate change mitigation strategy until 2050 of the Republic of Bulgaria,
 Climate change adaptation,
 National climate change action plan.

2.2.3.12.2. With the technological component - Digital infrastructure

- National broadband infrastructure plan for next-generation access, Cybersecurity - National strategy for cybersecurity "Cyber-resistant Bulgaria 2020", Scientific research and innovation (ICT), National strategy for the development of scientific research in the Republic of Bulgaria 2017 – 2030, National road map for scientific infrastructure (2017-2023) Horizon 2020 Research and Innovation Framework Program;

- *Education and training* – Strategy for the effective implementation of information and communication technologies in education and science of the Republic of Bulgaria (2014-2020), Plan for the implementation of the Strategy for the effective implementation of ICT in education and science (2014-2020);

- *Adaptation to the labor market* – education, training and social protection National Employment Action Plan (EAP) – annually adopted by the government;

- *Digital economy* – The Innovation Strategy for Smart Specialization 2014-2020 (ISIS) Concept for Digital Transformation of Bulgarian Industry (Industry 4.0);

- *Agriculture* – Strategy for digitization of agriculture and rural areas of the Republic of Bulgaria;

- *Transportation* – Integrated transport strategy in the period until 2030. Strategy and national plan for the implementation of the European Railway Traffic Management System (ERTMS) in the Republic of Bulgaria, Strategy for the implementation of the technical specifications for interoperability for the conventional railway system of the Republic of Bulgaria 2013 - 2030 , National plan for the implementation of the technical specifications for interoperability regarding the subsystems "Control, management and signaling" of the 39 railway system in the EU, Strategy for the development of road infrastructure in the Republic of Bulgaria 2016 - 2022 and Medium-term operational program for the implementation of the strategy; Digital Health Strategy 2021-2027, National Concept for Spatial Development 2013-2025, Regional Spatial Development Schemes of Level 2 Regions Documents for Integrated Development of Municipalities;

- *Digital government* – The updated strategy for the development of e-government for 2019-2023. Updated Roadmap for the implementation of the Updated strategy for the development of e-government in the Republic of Bulgaria 2019-2023, etc..

In summary, **Table 1** shows the impact of the factors influencing the implementation of green digitalization measures, systematized according to their strength.

Table 1. Impact strength of factors affecting the implementation of green digitalization measures

Impact force	Endogenous factors (internal environment)	Exogenous factors of the context (the external environment)
Barriers or inhibiting factors		
Highly inhibiting	<ul style="list-style-type: none"> Inadequate knowledge and awareness about the possibilities of green digitalization and an underdeveloped culture for green digitalization, a poorly expressed ecological component in management Deficits in strategizing the theme of green digitalization in the vision/strategy/planning Deficits regarding availability/competence of human resources regarding green digitalization Lack of resources and difficult access to financing 	<ul style="list-style-type: none"> High rates of climate change and environmental degradation Global risks to food security, resource scarcity and rising food and energy prices Issues with energy independence and the safety of critical energy infrastructures Digital hyper-connectivity and technological transformation Pressure on democracy, military action in Ukraine
Moderately inhibiting	<ul style="list-style-type: none"> Workload and competing priorities Low innovation activity and deficits in technological resources Underdeveloped performance evaluation processes/KPI Low level of stakeholder involvement and partnerships Low intellectual property registration activity 	<ul style="list-style-type: none"> Realignment of available funding due to undertaking defense investment Changes in demographics Consequences of the COVID-19 pandemic
Weakly inhibiting	<ul style="list-style-type: none"> Low intellectual property registration activity Low levels of business internationalization 	<ul style="list-style-type: none"> Insufficient maturity of consumer demand for green products/services
Activating or stimulating factors		
Highly stimulating	<ul style="list-style-type: none"> Strong economic component of green investments (resource saving, more economical production or cost reduction) Strong business component (positive business effect, optimization of processes, accumulation of data, compliance with environmental standards, better access to public procurement) Experience with solutions for green digitalization and good practices Trend towards digitization of processes Competence in the field of digitization Encouraging eco-innovation and reducing the ecological footprint 	<ul style="list-style-type: none"> Supporting measures for green digitization policies/regulatory requirements at EU and national level Funding opportunities for green digitization measures and access to financial instruments Growing potential of digital technologies Increasing supply chain influence with expanded scope of partner requirements on environmental performance Growing influence of the topic ESG and mandatory reporting of the non-financial performance of companies, including an environmental component
Moderately stimulating	<ul style="list-style-type: none"> Opportunities to grow or scale the business, virtualize products or services, reorganize the value chain 	<ul style="list-style-type: none"> Institutional support from the state Opportunities for industry support and partnerships Availability of good practices and generated experience with green digitization measures by enterprises in the sector/country

Good practices of Green Digitalisation

Positive examples of the implementation of green digitalization have been identified. For objectivity in the selection of good practice, it is necessary to select criteria that they meet.

Criteria for selecting good practices:

1. Use of innovative technological solutions for digitization
2. The specific business decision integrated into the general management philosophy as an element of an integrated approach
3. Prominent "green component" of digital solutions
4. Demonstrated leadership, management vision and strategy
5. Resource security of the processes
6. Involvement and engagement of stakeholders and active mobilization to optimize effects
7. Performance in the direction of sustainability, incl. environmental performance
8. Long-term effects in terms of fostering a culture of sustainability
9. Opportunities to upgrade/multiply the good practice.

Lessons learned and perspectives

In the context of green digitalization, some perspectives for future development in this direction can be summarized, based on the experience already gained:

- **Vision and innovative approach:** Different good practices convincingly prove the power of management vision and the effectiveness of innovative approaches for a specific project not only to obtain its opportunities for implementation, but also to realize these opportunities. Where vision meets innovation, the necessary resources are identified, sought, and ultimately brought to work to achieve the intended goals. Given the significant differences between companies in terms of their needs and capabilities, practice shows that, although relatively rare at the moment, successful business projects of companies that, although small, possess high management capacity and far-sighted leadership manage to connect the vision with the opportunities. identify a problem and a potential technological solution, successfully carve out a niche market, and thereby make that same initially restrictive environment work for them.

- **Capacity to manage risk and opportunity and address change:** The possibilities of digital technologies to improve processes through their optimization or transformation and to promote new business models should find a favorable environment, with the organizations adopting them having the vision, the will, and the institutional and human capacity to make the necessary changes in their businesses and processes. Larger organizations usually already have accumulated resources, including

experience, and a proven vision to undertake such changes. The presented good practices, however, clearly demonstrate the realized as a real opportunity for startups of newly created forms with visionary management and innovative orientation to position themselves relatively well and use their creativity, vision and flexibility to make a breakthrough in the otherwise competitive and challenging business environment.

- **Internal fund of digital skills:** The creation or implementation of successful practices is a function of both the organizational knowledge that organizations have managed to create and maintain, and the overall competence at all levels: owners, management, employees to understand the need for change, the opportunities for improvement through digital solutions, the added value of these solutions, to manage data and analytics, etc. Successful organizations in green digitalization successfully manage digital talent, in a general environment where this talent is scarce and companies with significant resources compete for it. An important factor for success is teamwork in work, and the appropriate combination of competences both in the field of technology and in the field of ecology.

- **Environmental awareness and skills for managing aspects of the environment:** Green digitization measures have been successfully implemented where an environment of ecological culture and commitment to the environment exists and is maintained, visibly demonstrated in policies and practices and resourced with appropriate processes of creating/upgrading the relevant competence.

- **Knowledge of potential technological solutions:** Effective access to complete and reliable information about the potential of specific technological solutions to adequately address specific organizational problems unlocks the managerial vision towards identifying opportunities for green digitization projects. Geographically, connecting innovation hubs with markets and developing and expanding opportunities to exchange experiences and good practices are important for fostering innovation and creativity at the level of individual enterprises/organizations.

- **Integration into production processes:** Successful practices demonstrate sustainability where a specific project, including the installation and implementation of new operational technology, is integrated into the overall business value creation process.

- **Integration into the overall sustainability policy:** "Green" solutions, including green digitization measures, find their natural environment of adoption and development in organizations that have created, maintain and develop an integrated approach to sustainability. This approach includes both sustainability policies and operational controls to manage its aspects, including green resource provision policies, green public procurement, etc. In such an environment, specific measures/projects find not only their implementation, but also their successful and continuous improvement and development.

- **Data management capabilities:** Good practices demonstrate the role of effective monitoring, measurement and analysis and data tracking and management for the successful implementation of green digitization measures. Data governance is a necessity for the adoption and use of technology solutions and the lack of adequate policies/practices in this regard is a key challenge. Development requires that achieved performance, including environmental performance, be accurately tracked,

analyzed and reported to relevant stakeholders in order to identify, where necessary, appropriate adjustments and corrective actions, as well as opportunities for improvement. A successful risk-based approach depends on the quality of data management processes.

- **Flexibility of approach and adaptation to opportunities:** Good practices are characterized by flexibility of management approaches and appropriate timely adaptation of technological solutions to the specific opportunities on the ground. The market should also be prepared for the specific projects. This includes both the capabilities of the enterprises themselves and of their partners and supporting organizations. Active "green" marketing supports the development of the host environment, incl. consumer demand to an extent encouraging the adaptation of specific technological solutions and linking opportunities with supply.

- **Growing role of non-financial instruments.** The presented practices demonstrate that a number of non-financial instruments can be a powerful catalyst for stimulating green digitization projects. This includes tools that help stimulate demand for companies' products/services, promote information exchange and awareness, and adequate advisory services. More complex advisory services - business hubs, able to combine both financial and non-financial assistance, including help with networking and establishing links with others in the private sector, to help build more broad partnerships. Public procurement also plays an enabling role, particularly when it provides opportunities for companies to demonstrate sustainability policies and practices to their advantage. Used international standards also help companies improve their performance and gain recognition, which is configured as a competitive advantage. Such certification can be crucial for companies seeking to expand their market share not only domestically but also abroad..

- **Partnerships and stakeholder engagement:** The analysis of different practices shows that the potential of managerial approaches is to focus on removing barriers, solving sector-specific problems, and experimenting with innovative ideas/projects in the implementation of new technologies. Market-related experimentation in dialogue with the user provides feedback of particular value to the development of the project, navigating the possibilities and upgrading it to achieve the best end result for the client. Appropriate partnerships, including between representatives of different sectors, bring key benefits in terms of both resource security and development. Effective channels of exchange of knowledge and awareness work for the benefit of all stakeholders and are able to multiply the positive effects.

- **Exchange of good practices:** Analyzed practices demonstrate the constructive potential of examples of innovative and innovative approaches that, presented in an appropriate way, manage to find followers, be disseminated and thus realize a multiplier effect.

- **Dependence of processes on the effectiveness of national policies and on effective access to finance:** There is a need for business to be adequately supported at the national level, including by branch organizations. National policies and strategies that focus on building the internal capabilities of firms play a crucial role in the ability of organizations to absorb and adopt operational technologies and therefore accelerate the diffusion of green digitization measures. These capabilities include digital skills, management and organizational capacity (in particular change management) and the capacity to undertake business R&D. Some instruments include direct financial support. Grants, equity

financing, and loans help provide resources with limited upfront contributions from recipients, unless the grant requires a matching portion. They all suggest that the main challenge is access to finance. Expanding and facilitating access to finance has been identified as a critical success factor, even in cases of highly innovative products.

Green Digitalization at Consumer Level

The success of policies and strategies of the twin transition depends to a great extent on the competitiveness of "green" practices against conventional products and the adaptation of business to the new conditions of the environment. And this is directly related to the attitudes and behavior of consumers and their support for new business models. If there is no appropriate level of "acceptance" of ecological products by consumers, this would threaten their market realization, and hence the transition to a green economy at all levels.

Therefore, it is necessary to know and understand the key factors that influence consumers and play a role as drivers or barriers to green consumption, adoption of green products, environmentally responsible shopping, sustainable consumption and environmental innovation, respectively. It will allow businesses to adapt their product offerings and formulate appropriate "green" or "sustainable" product and marketing strategies. Consumer attitudes have an important role for the overall process of planning, implementation and development of measures for green digitalization, incl. production of green products and services, and decision-makers and those responsible for specific green marketing should direct efforts to a better understanding of the opportunities and challenges of green shopping.

Therefore, the factors influencing consumer behavior in green purchases are the subject of a growing number of multidisciplinary studies in the fields of psychology, sociology, behavioral economics and marketing. Several sets of factors are emerging that drive consumer decisions about their sustainable lifestyles and green consumption.

Large groups of factors are related to the products themselves: price, quality, functional characteristics, and availability. Studies suggest that functional and green features of a product form a core group of motives that influence consumers' green purchasing behavior.

The cost of green products or services continues to be a leading factor, with high cost acting as a deterrent to green purchasing behavior. This is undoubtedly more pronounced for users with more limited means. A number of studies have commented on the difficulty for consumers to focus on the long-term benefits of a green product when they are actually initially confronted with its cost.

The functional and sustainable characteristics of the products, combined with high quality, positively influence the ecological buying behavior of consumers. Conversely, poor product features and lower quality can lead to a conflict between consumers' personal needs and their sense of environmental and social responsibility. The health benefits, perceived quality and taste of the product are specific characteristics that drive the demand and consumption of green food products. In addition, the perception of poor product quality is an important barrier identified in many studies that affects green purchase decisions.

Limited availability and the inconvenience of purchasing green products are perceived as barriers. Consumers generally look for convenience, prefer products that are easily available, and do not like to waste time looking for green products.

When the unavailability of a product is combined with a high price, consumers become more resistant to purchasing such environmentally friendly products. The fact that they prefer an ecological product with favorable functional characteristics should lead manufacturers to focus on both green product characteristics and functional characteristics, that is, to look for innovative products that combine green and functional characteristics. Ensuring availability and accessibility in convenient locations and in variety is also of utmost importance.

Another key set of motivations for green purchasing behavior is consumers' growing concern for environmental and social issues. A number of researchers suggest that environmental, social and ethical values shared by consumers, along with their individual values, are among the most important incentives for purchasing green products. They assess various environmental, social and individual effects of purchasing a green product. In addition, individual values such as health and safety provide a favorable green purchasing behavior, which is more pronounced in the choice of green food products.

Currently, the consumer does not necessarily strive for "green" and "eco", but rather bets on economic rationality. Research shows that consumer attitudes have not yet matured to the point of orienting consumption in the direction of prioritizing the use of nature-friendly goods and services, with minimal or no carbon footprint, maximally energy efficient, included in the circular economy.

Related to environmental concern, important factors that influence green purchase intention and behavior are relevant information and knowledge of the consumer. Awareness of social and environmental issues has the potential to positively influence consumers' green purchase intention and behavior. Level of environmental knowledge also mediates green attitude and environmental behavior. More information is a factor in increasing consumer confidence in ecological products. Conversely, the lack of awareness and familiarity prevents consumers from realizing the added value of the actual purchase of green products.

Illustrative example of good design, but not so effective consumption are "smart" buildings. A growing trend is the introduction of energy-efficient buildings and, accordingly, the implementation of "smart" building management systems. However, the opportunities at stake are rarely exploited to their full potential. I.e. at the stage of planning and construction of the building, the use of "smart" solutions is emphasized, but at the stage of real exploitation of its possibilities - these "smart" possibilities are not used effectively enough. Among the reasons for this inefficiency is the lack of familiarity of the users of such office buildings regarding the full range of possibilities that smart systems and solutions offer. These issues are closely related to how effective the information dissemination methods used are to convince consumers of the benefits (individual and environmental) of consuming green products. Another aspect is that consumers are generally looking for simple and easy-to-use information to guide them in choosing green products. Here, on the one hand, the importance of sharing relevant information about so-called "green effects" in general, and on the other hand, the form of sharing such information, is imposed as a factor. Attention in this regard is to the introduction of special labels that provide details of the environmentally sustainable characteristics of the product.

Perceived consumer efficacy or the potential to “make a difference” are other important factors, the essence of which is expressed in the extent to which consumers believe that by choosing a particular green product they are actually having a real impact on solving the overall problem. In the literature, it is “consumers’ assessment of the extent to which their consumption can change the overall problem.” In this regard, the researchers highlight the existing positive correlation between perceived consumer efficacy and green purchase intention and behavior. In other words, the more convinced a particular consumer is that relevant changes in environmental factors depend on his personal behavior, the more inclined he is to target green products and services. Conversely, if he sees no real benefit in a wider situational plan, this motivation disappears and other factors take over.

The emotional attraction of the “green choice,” or specifically environmental concern, has a positive and direct impact on consumers’ green purchase intention and behavior. It is important to what extent this emotional appeal, shared by larger groups of users, becomes a social norm and a collective pattern of behavior. A study by the Organization for Economic Cooperation and Development shows that people can be motivated to make sustainable choices if a minimal number of other group members also do the same. An example of such a case is the greater propensity of certain consumers to install solar panels on their roofs if such a decision has already been made by their neighbors. This group commitment to a similar type of sustainable behavior emerges as an important motivational factor.

A deterrent to purchasing green products is adherence to the status quo, habits and automated choices. By definition, consumers adhere to an established pattern of automaticity of consumption, which is especially true if they do not have a high environmental and social concern or if their attention is not drawn to specific functional qualities of the green product. Possibilities to overcome such attitudes through a different type of promotion (eg hotel towel change practices) or through techniques such as introducing the green default option (consent to receive paperless bank statements) are seen as potential.

A problem shared by managers is related to the attempts to enforce a paperless office. The example is a brokerage company and a company for offering travel services, which, despite the company’s desire to minimize paper in daily work activities, is hindered by consumer attitudes, especially strongly manifested in the older segment of consumers, to own a paper copy of the documents.

Brand image is another important factor influencing the purchase of green products. It is defined as “the whole set of impressions, concepts and concerns about a brand in the memory of customers that are related to sustainability and environmental concerns”. Research has found that a positive brand image generally builds trust in the green features of products and facilitates purchases.

Consumer confidence (belief or expectation) in the green brand is another important motivational criterion in the purchase of green products. Lack of consumer trust in green products and confidence in green claims and green product features act as a barrier.

Factors acting as a stimulus for consumer confidence are eco-labelling and certification, respectively. Research shows that a small part of Bulgarian consumers recognizes ecological labels and purposefully looks for sustainable products on the market. This necessitates the need for additional information and training on environmental labels, certification schemes and their role in building a circular economy. Eco-labeling or eco-certification in principle support higher levels of consumer awareness about the green characteristics of the product, and these levels should act as a motivational factor in the purchase of green products.

By itself, eco-labelling could hardly influence the attitudes and behavior of consumers, respectively, if they do not trust the information provided or are skeptical of the certification procedures themselves.

There is a wide range of attitudes, ranging from companies that confirm the possibilities of eco-certification as an incentive to consume green products, to another group of respondents who question the objectivity and reliability of these processes. In this regard, it is necessary to conclude that eco-certification and eco-labeling do not automatically impose trust, but to build such trust with the aim of promoting more sustainable purchases, targeted efforts on the part of companies are necessary.

First of all, additional work is required for increasing the effectiveness of the labels themselves, which are comprehensible to consumers and contain as much easy-to-understand information about environmental impacts as possible. In order to increase the credibility of the information provided, the labels could be presented in the context of a wider information campaign where consumers have access to additional information on sustainability issues to help them recognize different eco-labels and to orient better about their meaning.

In the context of the factors presented above, it is clear that a variety of motives, attitudes, behaviors and barriers influence respectively motivate or hinder green purchasing behavior and influence the transformation of positive attitudes into actual actions.

The findings reveal that environmental concern and knowledge, values, and product characteristics emerge as the main driving forces, while high cost, low availability, and lack of consumer confidence in green products are structured as the main barriers to purchasing green products.

Appropriately addressing these factors involves actions at both the level of motivators and at the level of barriers. For example, environmental sensitivity should be nurtured and developed through appropriate forms of environmental education that provide awareness and knowledge of how the consumer can identify environmentally friendly products. Regarding barriers, the lack of trust should be addressed both through the introduction of products with eco-labels, which is a relatively easier and more economical way, and through focused campaigns to promote public awareness of eco-labels, informing about the meaning and availability of eco-labels and the benefits of using eco-labeled products.

Despite the growing willingness of companies to produce ecologically clean products and the corresponding growing willingness of consumers to buy such products, the studied factors do not interact in automatic conditions, but within a far more complex mechanism of detecting demand with supply. In this regard, the problem commented on in a number of studies that favorable consumer attitudes do not often translate into actual purchase actions of green products should be the subject of further research in a number of areas to determine the role of these factors and the extent to which they influence green purchase behaviour.

Manufacturers and retailers who are active owners of the processes in this regard must also realize the need for focused analysis of consumer attitudes, and of developing a relevant marketing strategy around these attitudes so that they can reach a larger number of users and convince them to buy their products and services. The very offering of green products, despite their potential as a unique product, with opportunities for new business, must be perceived in the context of consumer demand as well as consumer purchasing power. In this regard, promoting green purchasing is a mission that goes far

beyond solving the issue of higher prices and moves towards making "green thinking" part of the work culture and ethics of the organization.

References

- Aertsens, J., Mondelaers, K., Verbeke, W., Buysse, J., & Van Huylenbroeck, G. (2011). The influence of subjective and objective knowledge on attitude, motivations, and consumption of organic food. *British Food Journal*, 113(11), 1353-1378.
- Andreev, O., Peneva, G., 2018a. Problems Concerning Operations System of the Enterprise in the Context of Industry 4.0. Xth International Scientific Conference "E-Governance & ECommunications", 06, pp. 165-170
- Connell, K. Y. H. (2010). Internal and external barriers to ecoconscious apparel acquisition. *International Journal of Consumer Studies*, 34(3), 279-286.
- European Commission. A Europe fit for the digital age: https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age_en#documents
- European Parliament. Sustainable consumption, Helping consumers make eco-friendly choices, [https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI\(2020\)659295](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2020)659295)
- Fraj-Andrés, E., & Martínez-Salinas, E. (2007). Impact of environmental knowledge on ecological consumer behaviour: an empirical analysis. *Journal of International Consumer Marketing*, 19(3), 73-102
- Global Risk Report 2023, World Economic Forum, <https://www.weforum.org/reports/global-risks-report-2023/digest>
- Joshi R. and Rahman Z., 'Factors Affecting Green Purchase Behaviour and Future Research Directions', *International Strategic Management Review*, Vol. 3(1-2), 2015. Factors Affecting Green Purchase Behaviour and Future Research Directions Yatish Joshia, Zillur Rahman
- Muench, S., Stoermer, E., Jensen, K., Asikainen, T., Salvi, M. and Scapolo, F., Towards a green and digital future, EUR 31075 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-52451-9, doi:10.2760/977331, JRC129319
- Padel, S., & Foster, C. (2005). Exploring the gap between attitudes and behaviour: Understanding why consumers buy or do not buy organic food. *British food journal*, 107(8), 606-625.
- Peng C, Jia X and Zou Y (2022), Does digitalization drive corporate green transformation?—Based on evidence from Chinese listed companies. *Front. Environ. Sci.* 10:963878. doi: 10.3389/fenvs.2022.963878
- Survey on the contribution of ICT to the environmental sustainability of actions of EU enterprises
- Tanner, C., & Wölfling Kast, S. (2003). Promoting sustainable consumption: Determinants of green purchases by Swiss consumers. *Psychology and Marketing*, 20(10), 883-902
- Tomas Chamorro-Premuzic. The Essential Components of Digital Transformation, 2021. *Harvard Business Review*, <https://hbr.org/2021/11/the-essential-components-of-digital-transformation>
- Tsakiridou, E., Boutsouki, C., Zotos, Y., & Mattas, K. (2008). Attitudes and behaviour towards organic products: an exploratory study. *International Journal of Retail & Distribution Management*, 36(2), 158-175
- Young, W., Hwang, K., McDonald, S., & Oates, C. J. 2010. Sustainable consumption: green consumer behaviour when purchasing products. *Sustainable Development*, 18(1), 20-31

Links in Bulgarian:

https://www.europarl.europa.eu/doceo/document/TA-9-2022-0380_BG.html
https://go-green-barometer.ltu.bg/files/Report_Go-Green_Activity-1_full-version.pdf
<https://e-gov.bg/wps/portal/agency/strategies-policies>
https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/repowerEU-affordable-secure-and-sustainable-energy-europe_bg
<https://digital-strategy.ec.europa.eu/bg/policies/desi>
<https://www.tbmagazine.net/statia/industriya-40-ili-kakvo-oznachava-digitalizacijata-za-industriyata.html>
https://bulgarien.ahk.de/fileadmin/AHK_Bulgarien/News/Digitalization_Survey_Bulgaria-BG.pdf
https://www.mi.government.bg/files/useruploads/files/ip/kontseptsia_industria_4.0.pdf
<https://egov.bg/wps/portal/agency/strategies-policies/e-management/strategic-documents>
<https://www.mi.government.bg/politiki-i-strategii/>
<https://www.moew.government.bg/bg/ministerstvo/strategicheski-dokumenti/>
<https://www.moew.government.bg/bg/strategiya-i-plan-za-dejstvie-za-prehod-kum-krugova-ikonomika-na-republika-bulgariya-za-perioda-2021-2027-g-10910/>
<https://www.az.government.bg/pages/planove-i-programi/>
<https://www.sustainability.bg>
<https://www.nextgeneration.bg/14>
<https://www.bia-bg.com/news/view/26123/>
<https://www.eurekalert.org/news-releases/459880>
https://www.researchgate.net/publication/356612464_Digitalizacia_na_blgarskata_ikonomika
<https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age>