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THE APPLICATION OF GREEN TECHNOLOGICAL INNOVATIONS IN THE WORLD AND SERBIA

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Abstract: Technological innovation is defined as the process of introducing new or improving existing technologies with the aim of creating a new or significantly improved product, service or process, implying the application of scientific or technical knowledge in the generation of innovative solutions that increase productivity and efficiency, create added value, encourage economic growth and competitiveness, bring new business opportunities and enable greater adaptability to market changes. As a kind of mix of creative ideas, research and development (R&D) acitivies, technological innovations play a key role in the development of modern society, economy and industries. Their special dimension consists of green technological innovations that rely on the development and application of technologies aimed at minimizing the negative effects of people's activities on the environment and wider society. Green technological innovations are sustainable by their nature, which is why they are already

widely used in the green transition process. In addition to a detailed analysis of the concept and effects of technological innovations and their connection with the UN's Sustainable Development Goals (SDGs), this article also provides an overview of the most important technological innovations that are widely used in the world and in Serbia. Unlike the countries of the European Union (EU) and the region of Southeast Europe (SEE), which are more focused on digital and green technological innovations, recycling and various circular solutions are applied to a greater extent in Serbia, while smart and digital solutions are used to a much lesser extent. The article concludes that these innovations have enormous importance for the economy of Serbia, especially in the context of its sustainable growth and development, environmental protection and harmonization with EU standards, but that their ultimate success still depends on the achieved synergy between the state, policy makers, the private sector, the academic community and the citizens themselves.

Key words: technological innovations, sustainable development, green transition, green innovations, energy savings, pollution, renewable energy sources, GHG emissions.

INTRODUCTION

Technological innovation can best be described as the creation and use of new improved technological solutions, instruments, systems and processes that bring significant improvements or breakthroughs in various areas of business and private life. They almost always involve the use of new knowledge, expertise, experience and available resources to develop innovative solutions that serve to solve current problems, improve effectiveness, encourage progress and generate new value (Jain, 2023). As such, technological innovations transform our daily life, society, as well as products, services, processes and business models of modern companies, while increasing their productivity and efficiency, adaptability to market changes, as well as new business opportunities and their environmental friendliness dimension. In essence, all cutting-edge technological innovations are about the introduction of significant technological changes in the way of realizing activities and satisfying people's needs by using advanced technology (Repsol, 2024). These innovations typically involve cycles of incremental change and technological discontinuities that advance existing knowledge, leading to significant advances in organizational performance and the competitiveness of modern economies (Baum, 2001, p. 4049).

In the era of dominant climate changes facing modern society, technological innovations serve to influence the optimization of resource use, the minimization of harmful greenhouse gas (GHG) emissions, the reduction of pollution and waste, and the unlocking of new business opportunities, growing into key drivers of sustainable growth and development, as well as pivotal catalysts of overall change. They not only increase productivity and business efficiency, but also bring positive changes

to the environment, economy and society, by affecting resource efficiency and cutting GHG emissions, but also by promoting social inclusiveness and social equalities. Practice has shown that innovation and technological progress appear as key drivers in establishing a balance between economic growth and environmental protection requirements. Technological innovations contribute to transformative changes in value and supply chains, by stimulating competition, pushing industries towards more sustainable practical solutions, but also by opening doors to new industries based on environmentally sustainable practices. In this way, in the era of facing urgent global challenges such as climate change, reduction of available water and natural resources and growing demands for environmental and social corporate responsibility, technological innovations introduce us to a new phase of sustainable growth and development by promoting efficiency, accelerating the adoption of clean technologies and tackling environmental and social challenges (vGreens, 2024). Today, digital technologies are present in many spheres of business and social life, encouraging communication, cooperation, flexibility, effectiveness and agility, as well as the development of numerous digital innovations such as information and communication technology (ICT) production and service innovations, ICT enabled innovations and disruptive digital innovations that change established market patterns and bring dynamic and radical changes in industries, manufacturing and the service sector (Madžar, 2023, p. 147).

Technological innovations have a major impact on modern organizations since they disrupt markets, change the relative importance of resources and challenge organizational learning capabilities, while changing the very basis of their competitive advantage. At the same time, modern technologies develop over time through long-term cycles of small and gradual, incremental changes that affect the improvement and institutionalization of existing technologies, and sometimes interrupted by the appearance of technological discontinuities in which new and radically superior technologies replace the old ones, by making dramatic improvements in organizational performance. Today, the importance of technological innovations is indisputable and it derives from their numerous aspects. They contribute to the improvement of the quality of life, growth of competitiveness and make strong momentum for economic development. At the same time, technological innovations improve business efficiency and productivity. They cope more effectively with social challenges, impact scientific and technological progress, and effect inclusion and empowerment of their users, thus encouraging sustainable growth (Madžar, 2024, pp. 168-170).

TECHNOLOGICAL INNOVATIONS AND SUSTAINABLE DEVELOPMENT

Some recent research (Grimm et al., 2024, p. III) indicates that the reduction of economic activities would not necessarily lead to increased effects in the fight against climate change. According to these results, and contrary to prevailing attitudes and

opinions, deindustrialization in the countries of the European Union (EU) could significantly reduce the contribution to the fight against the climate change. Therefore, for the success of the green transformation, it is crucial to achieve a balance between economic growth and the fight against global climate change. In this regard, the importance of advanced technology and technological innovation comes to the fore as they figure as key drivers of shifting towards climate-neutral economies and of tailoring a global climate protection strategy. There are also opinions like Glavina et al. (2025) who emphasize the complex connections among economic systems, technological development and ecological sustainability that determine the adopted strategies for solving climate issues. The authors advocate for carbon capturing and environmentally friendly practices as key drivers of the green transition, paving the way to a sustainable future for every society and reaching a balance between economic growth and environmental responsibility. Although technological innovations lead to sustainable and environmentally friendly growth, the green energy transition requires huge investments in new power systems and is often accompanied by rising fossil fuel costs due to the fact that adoption of new technologies is not economically viable at the time of their launch. However, regardless of the position taken on this issue, the climate change leaves comprehensive and devastating socio-economic consequences that affect not only mainstream economic sectors, but also secondary, related and supporting industries, albeit with different levels of intensity. In addition, climate change is expected to have negative effects on other non-economic aspects of life, such as human and social security, health and well-being, history and culture, human capabilities and the state of the environment (OECD, 2015, p. 21).

In such circumstances, the importance of technological innovations comes to the fore, which can be said to have the greatest impact on the improvement of the economic, social and environmental dimensions of sustainability in rich developed countries, while they mainly contribute to the economic and ecological aspect in middle-income countries (Omri, 2020), indicating that the social dimension of sustainable development is complex and conditioned by a set of factors that go beyond the scope of advanced technological solutions. Nevertheless, these innovations affect social sustainability through the mediating role of organizational innovation and digital entrepreneurship. Technological innovations and new technologies have a beneficial impact on organizational innovation and digital business, through which they indirectly shape social sustainability (Weber et al., 2024, pp. 1-16). In this way, technological and green innovations are proven to improve the prospects of both short-term and long-term sustainable economic growth.

Technological innovations play a key role in fulfilling almost all the United Nations (UN) Sustainable Development Goals (SDGs), especially SDG3 (Good Health and Well-Being), SDG4 (Quality Education), SDG7 (Affordable and Clean Energy), SDG9 (Industry, Innovation and Infrastructure), SDG11 (Sustainable Cities and Communities), and SDG13 (Climate Action). Science and technological innovation contribute to the promotion of sustainable economic growth and development, improving the

performance of enterprises and strengthening the policy framework. Technological innovations also have a crucial role in achieving the SDGs by encouraging the efficiency and effectiveness of new and more sustainable development models based on research, knowledge exchange and cooperation among interested stakeholders in national and international frameworks (Berawi, 2017). Finally, the development of technological innovations, the transfer of modern technology and research and development (R&D) activities also influence the promotion of green development, the use of new technologies and the establishment of incentives for the nurturing and application of green innovations (UNIDO, 2022, p. 27). In this sense, all the mentioned SDGs call for further encouragement of innovations, stimulation of scientific research, improvement of technological capacities and expansion of international cooperation on the modern global society's path towards sustainable development. The following Table 1 shows the specific function of technological innovations that they have in fulfilling the aforementioned SDGs.

Table 1. The function of technological innovation in meeting the selected SDGs

SDG	Function
SDG3 (Good Health and Well-Being)	Technological innovations have revolutionized the provision of health services. On the other hand, the development of digital health technologies has improved their quality, while reducing costs and improving the health of patients.
SDG4 (Quality Education)	Technological innovations have noticeably improved access to higher quality education, enriching the learning experience itself through the use, adaptation and personalization of educational services.
SDG7 (Affordable and Clean Energy)	Technological innovations also reduce dependence on fossil fuels, as well as they prompt transition to clean energy, contributing to climate change mitigation, energy efficiency improvements, and sustainable, reliable, and affordable energy.
SDG9 (Industry, Innovation and Infrastructure)	Science, technological innovations and ICTs are essential drivers of industrial innovations and infrastructure development, providing a specific contribution to the sustainability and efficiency of industrial branches by encouraging the transition to smart production and circular economy.
SDG11 (Sustainable Cities and Communities)	Technological innovations such as Artificial Intelligence (AI), cloud computing, Internet of Things (IoT) and block chain technology contribute to the development of sustainable and smart cities, while encouraging the development of the local digital economy, quality of life, community inclusion, environmental protection and infrastructure development.
SDG13 (Climate Action)	Technological innovations such as digital technologies, renewables and climate information also provide powerful tools for adapting to and mitigating the negative consequences of climate change.

Sources: Authors' analysis based on RELX SDG Resource Center (2025), Government of Dubai (2023) and The Global Goals (2025)

TECHNOLOGICAL INNOVATIONS IN THE GREEN TRANSITION PROCESS

With its European Green Deal, the EU has set ambitious targets for carbon neutrality by 2050, with the aim of transforming itself into a modern, resource-efficient, clean and competitive economy without harmful GHG emissions. In this process, technological and green innovations play a prominent role in stimulating economic growth, strengthening competitiveness, penetrating new markets and reducing business costs. Renewable energy sources and technological innovations have synergistic effects on green growth, improving economic outlooks and contributing to environmental sustainability, while the achieving carbon neutrality requires technological advancement in terms of the use of renewables, carbon sequestration, as well as the application of digital technologies and smart systems (Kwilinski et al., 2025). However, although renewable technologies and other mature technological solutions play a pivotal role in these processes, the current speed and scope of innovation are not sufficient to realize the goal of net zero GHG emissions. To solve this problem, strong and effective policies to encourage innovation in the fight against extensive climate change are needed, as well as the commitment of policy makers to this overall goal. However, recent research indicates that over the past decades there has been a slowdown in technological innovation and a reduction in climate-related R&D activities in almost all of the most significant innovative countries in the world. In addition, in the past three decades, public policies have focused more on implementation than on providing concrete support for R&D activities (OECD, 2025).

At the same time, green growth is a convenient means for achieving the economic, social and environmental goals of sustainable development. Green growth also represents an opportunity to encourage the sustainability of existing industries, but also for the development of new ones, with the visible impact on diversification of the economy. The use of technological innovations for the green transition and facing the challenges of climate change usually requires extensive application of green technologies, especially in pivotal sectors such as electricity generation, transport and industrial production. Still, in order for new technologies and technological innovations to be applied in general, it is necessary to boost further investments in R&D, while strengthening of market competition, commercialization and expansion of new green technologies into current and planned policy actions (Green Policy Platform, 2025). However, many modern technologies are not aligned with the overall goals of environmental protection. Despite this fact, the latest technological solutions can still help us reconcile with the environmental requirements, especially considering the fact that contemporary technological innovations such as electric vehicles (EVs), Artificial Intelligence (AI), Internet of Things (IoT), block chain carbon trading and the digitization of the economy lead to a reduction of harmful GHG emissions, waste and the use of fossil fuels. Modern technologies can even neutralize the negative consequences of previous ones, paving the way for modern society towards a better,

fairer and more sustainable scenario. Contemporary literature sources mainly mention on the following major categories of technological innovations that are widely used in the process of green transition around the world (Fletcher, 2023; McGrath and Jonker 2025; Madžar et al., 2024, pp. 64-65):

1. 5G technologies – which provide high speed Internet, by enabling remote work, and thus less traffic and less GHG emissions into the atmosphere. Modern 5G networks, and especially AI driven technologies, can also help in the detection of forest fires, encouraging the fight against the degradation of precious forest resources and the development of sensitive natural ecosystems.
2. Electric vehicles (EVs) – although they generate certain carbon emissions during their production and charging process, they still represent one of the most significant technological innovations of the modern era. EVs contribute to the reduction of reliance on the use of fossil fuels and the decrease of personal emissions, while also their batteries can be successfully recycled, contributing to the reduction of hazardous waste and boosting environmental protection.
3. Green construction – which implies the use of more sustainable and cleaner building materials, and therefore the reduction of energy losses, water use and CO_2 emissions. Green building also protects biodiversity and natural ecosystems. Green buildings with wildflower roofs represent an excellent means of protecting flora, insects and birds in increasingly urbanized areas. Green buildings also reduce the environmental impact of all operations that take place inside buildings. In addition to green roofs and energy-efficient solutions, these examples include the use of sustainable building materials that further reduce energy, water and waste generation in modern buildings.
4. Green urbanism – as an effort towards shaping environmentally suitable and cleaner cities by developing and using electric public transportation systems, constructing energy-efficient buildings, using renewables and generally greening public areas. Green urbanism emphasizes the expansion of green areas in cities and encourages the electrification of mobility, while reducing waste and harmful carbon emissions. In addition to environmental protection, this approach is also aimed at prioritizing social sustainability and the concept of a healthy community, at the same time by insisting on the expansion of green public areas, creation of new parks, afforestation, and water and air purification, thus enhancing favourable environmental changes.
5. Digitalization – which has contributed to the growth of productivity and business efficiency around the world, and thus to the emergence of paperless business, contributing to the protection of forests and the whole environment.
6. The Internet of Things (IoT) – as a revolutionary tool that is, in the context of the topic of this paper, mostly used in modern agriculture. Agricultural IoT technological innovations enable farmers to ration the use of artificial fertilizers and pesticides, all of which contribute to the reduction of

environmental degradation, waste and pollution. In addition, these technologies are used to monitor soil quality and irrigation systems' efficiency with the aim of reducing water waste.

7. Rainwater harvesting – this method of water collecting has become very popular, especially in times of drought, wildfires and soil erosion. In the meantime, rainwater harvesting technologies have been developed into systems that convert rainwater into clean drinking water, contributing to the protection of water and reduction of water losses.
8. Block chain technologies – which are usually used to monitor the functioning of carbon markets and ways of calculating carbon credits, thus encouraging the transparency of clean energy trade. In addition to these technologies, there are also specialized software for monitoring carbon emissions that allow companies to determine emission hotspots, set specific goals and trace progress towards sustainable business.
9. Remote sensing – these technologies support efforts to conserve flora and fauna and monitor the effects of climate change, at the same time by reducing GHG emissions and supporting the environment. Remote sensing technologies mainly use drones and satellite devices along with cloud-based technologies to collect data from various sources, providing deeper insights into the state of the environment.
10. Solar panels – as a conventional and widely known source of renewable energy.
11. Wind farms – their functioning relies on kinetic energy; as the wind pushes the turbines, the generator converts the wind's mechanical energy into power. These green technological innovations leave a minimal carbon footprint, which makes it a suitable alternative to hydropower plants that can have negative effects on local ecosphere, and especially on water ecosystems.
12. Smart agriculture – as a form of modern sustainable agricultural practice that contributes to food security and reduces the negative impact of agricultural production on the environment. Smart agriculture includes many examples, especially precision agriculture that is based on sensors and data collection, which are then processed and analysed with the aim of optimizing the use of production resources.
13. Waste and wastewater management – green technological solutions can also help in more sustainable waste management. Modern waste management technologies typically include advanced recycling and wastewater treatment facilities that convert waste into energy, useful resources, drinking water, or raw materials needed for further manufacturing processes.

All mentioned green technological innovations are aimed at supporting sustainability, i.e. meeting the needs of current generations, but not to the detriment of future ones. They limit the harmful impact of various production and life activities on the environment in various ways, including reducing energy consumption, encouraging energy efficiency, reducing carbon emissions into the atmosphere, purifying

waste water, enhancing circular solutions, as well as considering the entire life cycle of a product or service, while encouraging the creation of innovative solutions that bring tangible benefits to society as a whole (McGrath and Jonker, 2025).

THE APPLICATION OF GREEN TECHNOLOGICAL INNOVATIONS IN SERBIA

Serbia ranked in the group of emerging innovators with its overall achieved Innovation Index value of 62.8% compared to the EU average in 2024, which is increasing more slowly than in EU countries (by about 10%). Since 2017, the country has strengthened its scientific research framework, showing constant improvements in the quality of published scientific articles, as well as in international cooperation with the EU in terms of research and innovation. However, despite this, Serbia still faces many challenges in terms of the development of its digital skills since in 2024 its performance on this front was only 31.4% of the EU average, while the Government is making efforts to bridge this gap with various adopted strategic documents related to the development of innovations and digital economy, broadband Internet, and the work of start-up companies. Since 2017, a strong decline of environment-related technologies has been also observed in the country, while from the aspect of environmental sustainability, resource productivity and air emissions by fine particulates, the country is classified only as an emerging innovator. Compared to the previous year 2023, Serbia experienced a visible jump in exports of products based on medium and high technology (by 6.1%), primarily thanks to Germany as a key trading partner with a large number of companies and production facilities in the country. Despite this, environmental sustainability still represents a significant challenge for Serbia, due to low resource productivity and a downward trend in the development of technologies related to the environment (by 35.2% since 2017). With regard to the dimension of environmental sustainability, Serbia has committed to reduce harmful GHG emissions by 33.3% by 2030, and it has also adopted its Low Carbon Development Strategy for the period from 2023 to 2030, which commits to decrease emissions in the production of electricity and heat, increasing energy efficiency and increasing the share of renewables in its industrial sector (European Commission, 2024, pp. 2-5).

In Serbia, the process of energy transition is necessary both for the present and for the future despite the global crisis, while the path to clean energy and green economy is the only one that can ensure its sustainable energy and national security. The global crisis indicates that it is extremely important for every country to be self-sufficient and secure in its energy and food sector, which is why green energy itself is a fundamental prerequisite for national security and sustainable economic development of the country. By signing the Paris Climate Agreement and the Sofia Declaration, Serbia has clearly opted for green energy through adopting a plan to produce 45% of electricity from renewable sources by 2030. In this sense, a fair energy transition, reliance on renewables and encouraging innovation and investment in su-

stainable technologies are a key prerequisite for achieving environmental goals and increasing the country's competitiveness. In order to achieve these comprehensive goals, Serbia should also be committed to encouraging the sustainability of supply chains and their alignment with environmental, social and management standards of the EU, as well as the inclusion of the private sector in this initiative with the aim of improving the competitiveness of domestic companies and promoting sustainable development policies (NALED, 2024). Therefore, the latest technological solutions such as smart grids, solar panels, wind farms, digital energy and integrated energy systems represent a strategic issue for the development of Serbian green energy framework. It is estimated that the application of these technological innovations will enable various industrial sectors to improve their electricity supply, not only in a more efficient, but also in a more environmentally sustainable and acceptable manner (Biznis.rs, 2022). Therefore, Serbia should unquestionably focus on digitalization, protection of its natural resources and the environment, development of green technological innovations and integration of EU best practices at the national and local level.

However, unlike many EU countries and the states form the region of Southeast Europe (SEE), Serbia is still in the early stages of its green transition and the application of the core principles of sustainable development, with significant room for possible improvements. Unlike these countries, and as a result of a mix of internal and external challenges, the lack of public debate, the omission of key stakeholder groups, a kind of rentierism and clientelism in its energy sector, and the absence of financial institutions that would finance its green processes caused Serbia to lag significantly behind in meeting the umbrella goals of sustainable development, especially SDG7 (Affordable and Clean Energy), SDG9 (Industry, Innovation and Infrastructure), SDG12 (Responsible Consumption and Production), SDG13 (Climate Action) and SDG17 (Partnership for the Goals). Therefore, the key areas of improvement should be focused on the general decentralization and democratization of its energy sector, on initiating a broad public debate on these issues, strengthening the commitment of political structures to the sustainable development principles, and increased participation of public and private financial institutions interested in financing and crediting these processes. In this way, a harmony of individual and common interests aimed both at gaining profit, as well as at protecting the environment and realizing SDGs would be achieved (Rajaković, 2021, pp. 41-43, 60-61).

Although the literature on green technological innovations in Serbia is still thin and weak, from its review it can be observed that the country still has them to a certain extent. Thus, in 2020, the product named Biosporin won the leading prize at the National Competition for the Best Technological Innovation in Serbia – it is about a biodegradable material made from agricultural waste and mushrooms. This event indicates that there is still recognition of the problems that Serbia is facing in terms of harmful pollution, as well as that there is interest in innovations that can contribute to solving this problem. Biosporin was developed for a year and a half, to reach its commercialization stage today, where it is used for biodegradable packaging for single

use. Biosporin has all the same characteristics as Styrofoam, but unlike Styrofoam, it is an environmentally friendly solution. This material is biodegradable in contact with soil and moisture, which turns it into fertilizer within 4 to 6 months without leaving any waste (Dedić, 2020).

Also, other green innovations based on ideas about saving energy through the use of new technologies, producing energy from bio-waste, using organic waste to obtain compost, fertilizers and new materials, using hazardous waste for the production of high-quality fertilizer, and recycling textiles, paper, cardboard and cigarette packs in order to obtain new products have also been financially supported in Serbia recently. At the same time, innovations were also promoted that envisage the use of bio-waste for energy production, composting and the creation of new products (cosmetics, paints and varnishes, ecological glue), as well as the use of waste water from the wood industry to obtain innovative bio-products. Just some of these solutions are based on the use of new digital technologies such as Artificial Intelligence, software and mobile applications to reduce pollutant emissions from thermal power plants, optimize electricity consumption, and switch from fossil fuels to renewable energy sources. In particular, the ideas for the production of biodegradable bags from natural materials and the cultivation of insects whose larvae can decompose plastic stand out. Below is a more detailed overview of some of the examples of recently adopted technological and green innovations in Serbia (UNDP, 2022):

1. Replacement of the old oil-fired boiler rooms with a new gas and biomass ones – biomass will be obtained by drying fruit remains from production, which will be mixed with shredded wood residues. In this way, the fruit from which juices are produced will be 100% used.
2. Making decorative boxes from recycled paper scraps.
3. Production of fertilizer from hazardous waste – this innovation uses waste solutions of bases and acids by applying an innovative technological process.
4. IoT technologies – application of IoT devices with low energy consumption to monitor infrastructure in remote locations, as well as to optimize waste transportation, which leads to a reduction in energy and fossil fuel consumption.
5. Innovative mat made of natural materials for raising poultry – which, together with non-hazardous organic waste from farms, is used as a raw material for high-quality organic fertilizer, suitable for the reclamation of tailings.
6. Generation of bio-waste – collection of bio-waste from agricultural farms, mainly from orchards, as well as residues from pruning trees and bushes from public areas, and the use of this waste as biomass for obtaining energy in nearby biogas plants.
7. Textile industrial waste – collection of textile industrial waste, its storage in the Recycling Centre and sale for further use.

8. Green waste from parks and gardens – use of green waste from parks and gardens for the production of compost that will be used for maintenance and planting of urban greenery.
9. Inclusive circular recycling – making new products from empty cigarette packs, paper and cardboard, with the employment of people with disabilities. The goal is to develop an appropriate solution for recyclable food packaging from recycled paper, with the addition of innovative biological additives.
10. Production of biodiesel and pellets – through new ways of using chicken eggshell waste and used cooking oil.
11. AI software based models – for forecasting pollutant emissions from the *Kolubara* Thermal Power Plant. The developed software will be intended for engineers, who will be able to use it to improve emissions monitoring and achieve more environmentally efficient operation of the mentioned thermal power plant, which can contribute to reducing air pollution by up to 20%.
12. Solar composter and photo bioreactor for open space – this green composter consists of two interconnected parts: a) composter with organic waste and b) photo bioreactor with algae. Organic waste in the decomposition process emits methane and carbon dioxide, which algae absorb and convert into oxygen. The oxygen is then returned to the area where the organic waste is located and speeds up composting. In this way, compost, as an organic fertilizer, is produced faster, and since it is a closed system, there is no emission of harmful gases into the atmosphere.
13. Innovative methods of production of cosmetic preparations – which use raspberry seeds as waste from the process of producing fruit juices in order to make cosmetic preparations such as serums, creams and soaps.
14. Recycling of food waste – using food waste as a raw material for the production of bio-pigments with antibacterial and antifungal properties, which are used for the preparation of paints and varnishes.
15. Production of ecological adhesives – from agricultural and industrial waste.
16. Hardware and software – the use of which can optimize the consumption of electricity in households and in larger production systems.
17. *Energy Cube* mobile system – which will provide energy from renewable sources. This solution consists of solar collectors and a heat pump and has the ability to store electricity and heat.
18. Use of waste water from the wood industry – as a raw material for obtaining innovative bio products.
19. Production of biodegradable and compostable bags – from biodegradable polymer materials of natural origin, such as starch, which can also be obtained from waste.
20. Cultivation of mealworm insect larvae (lat. Tenebrio molitor) – as a source of high-protein feed for livestock and quality organic fertilizer. These larvae have the ability to decompose various waste and some types of plastic, such as Styrofoam, which reduces its amount in landfills.

21. Creation of hybrids by crossing different breeds of pigs – which can be fed with residues from agricultural production and the food industry, while reducing GHG emissions by about 50%, and the costs of feeding these animals by about 70% compared to raising standard breeds of pigs.

In addition to the mentioned examples of green technological innovations that are already widely applied in the country, the so-called chemical leasing is also very popular in Serbia as an innovative business model oriented to the provision of services and shifting the focus from the volume of sales of chemicals to the approach of added value. As a part of this business model, manufacturers sell chemical functions, while the main means of payment is the functional unit. The result of the model applied is a more efficient use of chemicals while reducing the risk associated with their use, as well as protecting human health. The application of this model has received numerous recognitions and merits, and it has also led to a reduction in the consumption of chlorinated solvents, as well as a significant reduction in the amount of waste. In addition to this innovative initiative, numerous innovations in the field of circular economy are still widely applied in Serbia, such as recycling tetra pack for the production of waterproof eco-boards, recycling multi-layer wrapping material for packaging beverages and liquid food, recycling plastics for new products, heating coffee chaff into briquettes, recycling waste tires, recycling the used antifreeze, ash processing and many others (Mitrović et al., 2017, pp. 27-36).

These innovative solutions also include the recycling of electronic waste, the application of smart garbage cans, the development of a network of electric chargers for electric cars and bicycles, the electrification of public transportation system, initiatives for the wider use of e-scooters and electric bicycles, the use of drones and IoT sensors for precision agriculture, solar pumps for irrigation, organic production and many others. Nevertheless, local ecological technological innovations in Serbia face their many challenges, primarily related to a lack of funding and investments for the development of green innovative initiatives and to limited knowledge in the field of green technologies, while the perspectives of their further development can be seen in the access to EU funds and funds of the Green Agenda for the Western Balkans, as well as in their potential for creating jobs in the green economy and exporting sectors.

CONCLUSION

This article is dedicated to the analysis of major technological innovations that are widely applied both in the world and in Serbia in the process of a fair green transition. In addition to prevailing innovations related to renewable energy sources and energy efficiency, which now largely represent a conventional and generally well known approach, green technological innovations in the field of digital infrastructure, green construction, specific new technology driven digital innovations, Artificial Intelligence and IoT technologies, remote sensors, smart waste management and smart

agriculture are leading in the contemporary world. Although Serbia still clearly lags behind EU and SEE countries in this regard, its direction towards green technological solutions is noticeable, as has been documented in the analysis above. However, unlike them, Serbia is focused more on public transport electrification, waste management, recycling and various circular solutions, and to a much lesser extent on smart and digital innovations.

Although Serbia has the opportunity to follow long-term sustainable paths of green growth, the country would have to mobilize itself more strongly around this goal since green growth strategies can simultaneously contribute to its economic growth, creating new jobs, protecting the environment and meeting the needs of the wider social community. However, for the realization of this ambitious development strategy, it is necessary to ensure stronger participation of the public and other interested stakeholders in the creation, implementation and evaluation of adopted green development policies. This is all the more so since the current Serbian development model is based on narrow macroeconomic policies, together with liberalized capital flows and abundant foreign direct investments (FDI) inflows that have not yet led to real growth in employment, high-quality economic development, freedom of entrepreneurship and more effective social protection (Macura, 2017, p. 3). In addition, the absence of decentralization and democratization of the Serbian energy sector, the lack of wider public debate on these issues, the absence of strengthening the commitment of political structures to the principles of sustainable development and the insignificant participation of public and private financial institutions in financing and crediting green development projects can be also observed. In this way, a harmony of individual and common social interests aimed both at the acquisition of profit, the protection of the environment and the realization of the core sustainable development principles could be created. Therefore, there is a strong need for the inclusion of elements of sustainability in the domestic model of growth and development.

In any case, green technological innovations are of great importance for Serbian economy, especially in the context of its sustainable growth and development, opening new jobs, environmental protection and harmonization with EU standards. Their importance can be seen from a) ecological aspect (reduction of pollution, increase of energy efficiency, reliance on renewables and reduction of harmful GHG emissions), b) economic aspect (creation of jobs, access to EU funds and increase of the country's competitiveness) and c) social and political aspect (health of citizens, clean environment, alignment with EU standards and decentralization of economic development). Finally, it is important to emphasize that green technological innovations are not only an ecological need, but also a strategic opportunity for Serbia to improve its economy, raise the quality of life of its citizens and to position itself as a regional leader in sustainable development. However, their wider acceptance still depends on the achieved synergy between the state, policy makers, the private sector, the academic community and citizens themselves.

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