Proposal of a conceptual framework for creating a model for the implementation of green growth indicators in the conditions of the Slovak Republic

Samuel Fekiač[1]*◉*, Iveta Hajdúchová[1]*◉*, Roman Dudík[2]*◉*, Kim Hortenská[2]*◉*, Martin Halász[3]*◉

[1]Department of Forest Economics and Policy, Faculty of Forestry, Technical University in Zvolen, Zvolen, Slovak Republic
[2]Department of Forestry and Wood Economics, Faculty of Forestry and Wood Sciences, Czech University of Life Sciences Prague, Prague, Czech Republic
[3]Department of Economics, Management and Business, Faculty of Wood Sciences and Technology, Technical University in Zvolen, Zvolen, Slovak Republic

*Corresponding author: xfekiac@tuzvo.sk

Abstract: Green growth promotes sustainable economic development by protecting the environment and efficiently using natural resources. Supporting green growth enhances long-term sustainability, quality of life, and climate change mitigation. This article aims to propose a conceptual framework for implementing green growth indicators in Slovakia by comparing their perception with that of the Czech Republic. A questionnaire survey was conducted among 3 281 Slovak and Czech forestry enterprises [Nomenclature of Economic Activities (NACE) classification 02.10], with 1 365 responses. The findings highlight significant differences in the approach to green growth indicators between small and large enterprises and between state and non-state enterprises. Additionally, the study examines how Slovakia and the Czech Republic manage these indicators, forming the basis for a conceptual framework for their implementation in Slovakia. The research contributes to the discourse on green growth and sustainability, key concepts in the 21st century.

Keywords: bioeconomy; circular economy; eco-efficiency; green transition; sustainability

The concept of green growth is a hotly debated topic in many countries today. The discussion on the concept of green growth has been developing since the 1990s, but in 2005, the concept was significantly applied in South Korea (Guo et al. 2020), where it was adopted as a policy emphasising environmentally sustainable economic progress, with the aim of promoting low-carbon and socially inclusive development (Vazquez-Brust, Sarkis 2012). This approach allows for the view of expenditures associ-

ated with preventing climate change not as costs, but rather as investments. The main concept is based on the principle of economic crises that offer an opportunity to eliminate outdated technologies that pollute the environment and to introduce fundamental changes towards sustainability (Hutajulu et al. 2024). Investment is thus seen as a driver of environmental restoration, supported by growth potential (Haberl et al. 2020; Hickel, Kallis 2020). Among the five forms of capital – natural, financial, human, social and physical – natural capital, including water, land, forests and minerals, is of key importance as it provides the basic conditions for human existence (Jermalavičius, Parmak 2012; EEA 2015). Natural capital includes not only the resources used in production processes, but also the ecosystem services provided by nature (Milligan et al. 2014). In the framework of the Green Growth Index, which was first introduced by the Global Green Growth Institute (GGGI) in 2019, the protection of natural capital is one of the four key dimensions of green growth (Acosta et al. 2019). This dimension is closely related to the efficient and sustainable use of natural resources, the creation of green economic opportunities and the promotion of social inclusion. Resource efficiency and sustainability mean achieving greater economic value while reducing resource consumption, ensuring that the quality of life of future generations is not compromised (Jansen 2013; Cheng et al. 2023). According to the Organisation for Economic Co-operation and Development (OECD 2011b), green growth refers to natural resources that continuously provide environmental services. Similarly, the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP 2012) emphasises that green growth also includes the need to enhance the Earth's natural capital. According to the OECD (OECD 2011a), the concept of green growth is based on measures that enable economic development while conserving natural resources and ecosystem services, thereby contributing to the long-term prosperity of a country. A green growth strategy emphasises investments and innovations that support sustainable development and open up new economic opportunities. Countries oriented towards green growth face challenges related to financing; therefore, the current sustainable development model is being expanded to include a financial component that is closely linked to economic, environmental and social aspects (Abbas,

Sağsan 2019). Quantitative and qualitative economic analysis, environmental impact assessment and sustainable development evaluation significantly influence the promotion of green growth and the improvement of sustainability (Zhang et al. 2018). The formulation and implementation of a green growth strategy are essential given the impact of social and economic activities on ecosystems, which can pose a risk to economic growth and development processes. Natural capital is often undervalued, which makes it difficult to manage it effectively (OECD 2011b). To achieve green growth goals, it is necessary to increase investment and support innovations that form the basis of sustainable development and, at the same time, bring new economic opportunities (Przychodzen et al. 2020). Promoting green growth requires a thorough examination of the conditions for its formation and an assessment of its impact on long-term sustainability (Dutz, Sharma 2012). Given the current environmental risks affecting ecosystems and climate conditions, we can argue that these factors are leading humanity to large-scale global changes (Kolawole, Iyiola 2023; Ide et al. 2023). The OECD has published a report on green growth indicators, which supports countries' efforts to develop while preserving natural resources, which is a key tool for managing global change (OECD 2017). According to Bouzarovski and Petrova (2015), green growth indicators are divided into five categories: environmental and resource productivity, natural resource base, environmental dimension of quality of life, economic opportunities and policy measures, and socio-economic context. These indicators provide an overview of the economic, social and environmental conditions that are important for sustainable development (Kwilinski et al. 2023). Their common goal is to improve the quality of life of citizens without damaging natural resources. In the Czech Republic, five priorities were defined, which are society, people and health, economy and innovation, regional development, landscape, ecosystems and biodiversity, and a stable and secure society (Sedliačiková et al. 2023; Hajdúchová et al. 2024). The divergence in national approaches to forestry-related policy and sustainability is also evident in technical forestry planning, such as rotation period determination (Korená Hillayová et al. 2022). These priorities were subsequently translated into green growth indicators and are: sustainability and equity, environmental and resource productiv-

ity, natural resource base, environmental quality of life, economic instruments and policy measures. The Netherlands considers the main indicators of green growth to be: environmental efficiency, natural resource base, environmental quality of life, and policy responses and economic opportunities (Baldé et al. 2011; Schenau 2017). Ukraine perceives green growth indicators as strategic development goals (Andryeyeva et al. 2020). Ukraine defines four groups of indicators: environmental and resource productivity, availability and use of natural resources, environmental quality of life, economic opportunities and policy responses (Green 2016; Kvasha, Musina 2016). The Netherlands, Ukraine and Poland subsequently define various subgroups of their indicators, which we have not listed for the sake of comprehensiveness of their understanding. In these subgroups, it is possible to see a high diversity in the perception of individual countries (Herman et al. 2023; Abbas et al. 2024). In Slovakia, green growth indicators are divided into four main categories: environmental and resource productivity, natural wealth base, environmental quality of life and economic instruments and policy measures (Guštafíková 2011; OECD 2013, 2014):

Environmental and resource productivity. Environmental and resource productivity focuses on the efficient use of natural resources in order to achieve maximum economic output with minimum resource consumption, while minimising environmental impacts. Indicators such as CO_2 productivity, energy productivity, energy intensity in different economic sectors, the share of energy from renewable sources in total consumption and the share of electricity from renewable sources are monitored.

Natural wealth base. Natural wealth base points out that the depletion of natural resources poses a risk to economic growth, thereby emphasising the need for efficient and sustainable use of resources. Renewable resources are monitored, such as the development of forest areas, the state of forest reserves and their use, as well as the intensity of surface and groundwater use. In the case of non-renewable resources, mineral reserves and extraction are monitored. Biodiversity and ecosystems are assessed through the threat to species and changes in land use.

Environmental quality of life. Environmental quality of life reflects the impact of the state of the environment on human health and quality of life,

including the consequences of pollution on public health. Environmental health and risk factors such as population exposure to PM10 particles (harmful particles that do not exceed 10 μm in diameter), urban air quality and average life expectancy are monitored. Access to services such as the availability of public sewerage and water supply are also taken into account.

Economic instruments and policy measures. Economic instruments and policy measures are used to assess the effectiveness of policies aimed at green growth. Prices and environmental taxes are monitored [share of environmental taxes in total tax revenues and GDP (gross domestic product), electricity and gas tariffs for households, costs related to water management]. Innovation is also monitored, including investment in research and development. Voluntary environmental instruments such as ISO 14001, green public procurement, environmental management systems and eco-label awards are also monitored.

Based on the various definitions and international approaches presented above, green growth can be understood not only as a set of environmental or economic measures, but as a comprehensive development philosophy. In our view, green growth represents a dynamic and balanced interaction between economic development, environmental responsibility, and social equity, aiming to ensure long-term prosperity without exceeding ecological limits. This concept relies on the responsible use of natural capital, the integration of sustainability into strategic planning, and the ability of enterprises and institutions to innovate in response to global environmental challenges. Our perception of green growth is based on the concept of systemic transformation – specifically, the transformation of public policies, corporate environmental strategies, and socio-economic norms – with the objective of maintaining economic competitiveness while measurably reducing negative environmental impacts. It is on this foundation that we formulate our conceptual framework for the implementation of green growth indicators in the Slovak Republic.

The main goal of the article is to create a draft conceptual framework for creating a model for implementing green growth indicators in the conditions of the Slovak Republic by comparing the perception of green growth indicators with the Czech Republic.

MATERIAL AND METHODS

The data necessary for the identification of green growth indicators were collected by analysing secondary sources that dealt with green growth and its indicators in the conditions of the Slovak Republic in comparison with green growth indicators in the Czech Republic. Within this part of the research, the methods of analysis, synthesis, summarisation, description, comparison, deduction and analogy were applied. Based on knowledge about green growth and relevant indicators, we designed a questionnaire survey, which was distributed via the Google Questionnaires platform and sent by email from January 1, 2024, to March 5, 2024. This approach is in line with previous forestry-focused surveys aimed at capturing societal and enterprise-level perspectives (Sarvašová et al. 2025). According to data from FinStat (2024), there are 12 543 active enterprises in the forestry sector in Slovakia, compared to 9 527 in the Czech Republic. The research sample consisted of 3 281 randomly selected Slovak and Czech forestry enterprises that are engaged in activities in the given area according to the SK NACE classification (code 02.10) and the CZ NACE classification (02.10). The return rate of the questionnaires reached 41.60% (1 365 enterprises). The research sample consisted of 3 281 enterprises from Slovakia and the Czech Republic that were initially identified according to the SK NACE (02.10) and CZ NACE (02.10) classifications. However, recognising the limitations of relying solely on statistical classifications – which may include entities with marginal or unrelated activities – the sample was subsequently refined. Only those enterprises that demonstrably operated within the core areas of forestry and forest management were included, particularly those focused on activities such as forest cultivation, logging, afforestation, protection, and sale of forest products. This selection ensured that the sample represented businesses with a direct and relevant connection to the forestry sector.

The enterprises were subsequently divided into four groups: state-owned enterprises, non-state-owned enterprises, small enterprises, large enterprises. This decision was made in order to more effectively track differences in approaches to sustainability and green innovation, which can differ significantly depending on the size of the enterprise. Large enterprises generally have greater financial and technological capabilities to implement comprehensive environmental measures, while small enterprises may face constraints in terms of available resources and capacities. The distinction between state-owned and non-state-owned enterprises allows for a deeper understanding of differences in approaches to green growth, which may be influenced by the nature of ownership and the incentives of these entities. State-owned enterprises are often bound by public policies and national strategies that promote sustainability and environmental responsibility. They also have access to public resources and may be required to comply with certain environmental standards, which may lead to higher implementation of green measures. On the other hand, non-state-owned enterprises (private or commercial) may have a freer approach to the choice of environmental measures, while their motivations for implementing green measures may be more economic (for example, cost reduction) or dependent on market and consumer pressure.

The questionnaire questions were divided into two groups. The first group of questions, marked as A, concerned information about the company's registered office, legal form, size and type of services provided. The second group of questions, marked as B, focused on questions related to green growth and green growth indicators. We were interested in, for example: the use of green growth, the use of electricity from renewable sources, monitoring the carbon footprint, increasing forest cover, the overlap of part of the territory in a protected area, the green growth/sustainability strategy, the principles of sustainable development, eco-labels, the use of EMS (Environmental Management Standard), registration in EMAS (Eco-Management and Audit Scheme), the use of certificates, waste recycling and the use of environmentally friendly technologies. The third group contained only one question focused on the vision of the future in terms of the sustainability of forestry and green growth. In the final phase, the data obtained from the questionnaire survey were processed, and Microsoft Excel (Version 2024, 2024) was used to analyse the results.

RESULTS AND DISCUSSION

A total of 1 365 forestry enterprises operating according to the SK NACE (code 02.10) and CZ NACE (code 02.10) classifications participat-

ed in the questionnaire survey. The questionnaire survey managed to combine the results from all self-governing regions of the Slovak and Czech Republics. The enterprises that participated in the questionnaire survey were selected randomly from the database obtained through the FinStat portal (FinStat 2024). The results of the characteristics of the research sample are presented in Table 1.

Table 1 presents the structure of the research sample based on the number of forestry enterprises that responded to the questionnaire survey. The values reflect the distribution of participating enterprises by country, size, and legal form. The sample characteristics were further enriched with data on the specific types of forestry services provided by the surveyed enterprises in the Slovak Republic and the Czech Republic. These data represent the individual sectors in which the companies operate (Table 2).

Table 2 provides an overview of the types of forestry services reported by the surveyed enterprises in Slovakia and the Czech Republic. Respondents were allowed to select multiple service types that apply to their operations; therefore, the percentages do not sum to 100%. The data reflect the distribution within each country's respondent group. In reclassifying the types of services, efforts were made to distinguish core forestry operations (e.g. logging, afforestation) from secondary or supportive services. This improves clarity and helps focus the analysis on direct forest management practices. The data show that in both countries, enterprises are most represented in the sale of raw wood and in logging, which indicates a high orientation towards primary production in the forestry sector. Slovak enterprises show a slightly higher share in operating activities for the public and afforestation (23% in both cases) compared to Czech enterprises, where these activities account for a lower share (15% and 20%). Czech enterprises, in turn, have a slightly lower share in logging (20%) compared to Slovak enterprises (27%), which may indicate differences in the approach to the use of natural resources or in legislative and environmental regulations of both countries. In the category of forest cultivation and protection, the values are the same for both coun-

Table 1. Characteristics of the research sample

Representation by country			
SR		CR	
59%		41%	
Business size			
No. of employees	%	No. of employees	%
1–9	49	1–9	15
10–49	43	10–49	52
50–249	2	50–249	3
250+	6	250+	30
Legal form of business			
state-owned enterprise	36	state-owned enterprise	55
L.L.C.	45	L.L.C.	39
J.S.	13	J.S.	3
self-employed	6	self-employed	3

SR – Slovak Republic; CR – Czech Republic; L.L.C. – Limited Liability Company; J.S. – Joint Stock Company

Table 2. Characteristics of the type of services provided by companies in the Slovak Republic and the Czech Republic (%)

State	Operating activities for the public	Afforestation	Sale of seeds and seedlings	Forest cultivation and protection	Sale of raw wood	Logging
SR	23	23	15	20	30	27
CR	15	20	15	20	25	20

SR – Slovak Republic; CR – Czech Republic

tries (20%), which indicates the identical importance of this activity within sustainable forestry. The overall structure of the services provided thus points to slight differences between Slovakia and the Czech Republic, which may reflect regional specificities, market conditions and possible differences in legislative frameworks relating to forestry and environmental protection.

After the characteristics of our research sample, the next part focused on questions regarding green growth indicators. In Table 3, we can observe the difference in individual answers between Slovakia and the Czech Republic in terms of individual groups of green growth indicators and their distribution between state-owned and non-state-owned enterprises. To simplify the table, we decided to indicate individual indicators by abbreviations: environmental and resource productivity (ERP), natural wealth base (NWB), environmental quality of life (EQL), and economic instruments and policy measures (EIP).

Table 3 provides a comprehensive overview of the application of sustainability and green growth principles among state-owned and non-state-owned enterprises in the forestry sector in the Slovak and Czech Republics. The results show that enterprises in both countries generally support the idea of green growth, but there are differences in the implementation of specific sustainable practices. State-owned enterprises in the Slovak Republic have a higher share in the use of green energy, but lag behind in monitoring their carbon footprint. In the Czech Republic, there is a higher involvement of state entities in increasing forest cover in protected areas, which indicates their greater emphasis on protecting natural resources. In the area of environmental quality of life, including strategies and principles of sustainable development, there is a tendency for higher participation by state-owned enterprises in both countries, which may indicate their increased responsibility towards social and environmental obligations. Economic instruments and policy measures appear to be an area where financial and administrative barriers still pose a challenge, especially in the implementation of environmentally friendly technologies and management systems. These findings align with prior research on corporate social responsibility in Slovak forestry enterprises, highlighting different levels of environmental commitment (Hajdúchová et al. 2019).

Table 3. Indicators of the Slovak Republic and the Czech Republic, divided between state-owned and non-state-owned enterprises

Group of indicators	Indicator	State		Non-state	
		SR (%)	CR (%)	SR (%)	CR (%)
General info	using green growth	65	56	60	53
ERP	electricity from renewable sources	65	72	60	73
	carbon footprint tracking	88	94	90	100
NWB	increasing forest cover	58	61	53	67
	part of the territory in a protected area	88	89	57	60
EQL	green growth/sustainability strategies	82	78	53	74
	principles of sustainable development	71	89	77	53
EIPM	eco-label	53	50	77	73
	using EMS	100	78	87	93
	EMAS registration	100	83	90	100
	using certificates	89	78	57	53
	waste recycling	59	78	80	53
	environmentally friendly technologies	53	83	90	53

ERP – environmental and resource productivity; NWB – natural wealth base; EQL – environmental quality of life; EIPM – economic instruments and policy measures; EMS – Environmental Management Standard; EMAS – Eco-Management and Audit Scheme; SR – Slovak Republic; CR – Czech Republic

In the following table, we will look at the individual data once again, this time from the perspective of small and medium-sized enterprises in the Slovak and Czech Republics. To simplify the table, we have decided to again use abbreviations for the individual indicators: environmental and resource productivity (ERP), natural wealth base (NWB), environmental quality of life (EQL), and economic instruments and policy measures (EIP). The data in question are presented in Table 4.

Table 4 presents the differences in the implementation of green growth and sustainable practices between small and large forestry enterprises in the Slovak and Czech Republics. The results show that in most sustainability indicators, large enterprises in both countries are more active than small enterprises. Large enterprises use green energy more often, monitor their carbon footprint and are more involved in the protection of natural resources, with a significant part of their forest land located in protected areas. In the area of environmental quality of life, such as the implementation of a green growth strategy and adherence to the principles of sustainable development, a higher level of participation of large enterprises is visible, which seems to better reflect societal expectations and regulatory requirements. Large enterprises also more often implement economic instruments

and policy measures, such as ecological certificates, waste recycling and the use of environmentally friendly technologies, which indicates their greater potential for investment in ecological innovations. On the other hand, small businesses, especially in the Czech Republic, lag behind in implementing environmental management systems and certifications, which may be a consequence of their limited financial and technical capacities.

In the last part of the questionnaire, we were interested in the respondents' views on the future of sustainable forestry and green growth. Table 5 summarises responses to a multiple-choice question assessing the outlook of forestry enterprises on the future of green growth. Three of the four statements represent a positive or optimistic expectation, while one expresses a negative view (stagnation).

From Table 5, we can observe that in both countries, respondents demonstrated positive expectations, with a noticeable share of respondents believing that forestry will align with sustainability principles. This attitude signals confidence in the sector's adaptation to environmental standards, which may be motivated by the growing pressure for sustainability. Respondents in both countries see the growing demand for sustainable products as a key factor that will motivate businesses

Table 4. Indicators of the Slovak Republic and the Czech Republic divided between small and large enterprises

Group of indicators	Indicator	Small		Large	
		SR (%)	CR (%)	SR (%)	CR (%)
General info	using green growth	65	59	75	73
ERP	electricity from renewable sources	65	68	75	81
	carbon footprint tracking	95	100	75	91
NWB	increasing forest cover	56	68	50	55
	part of the territory in a protected area	72	50	75	100
EQL	green growth/sustainability strategies	63	68	50	100
	principles of sustainable development	56	59	100	100
EIPM	eco-label	52	65	50	54
	using EMS	95	91	50	73
	EMAS registration	43	95	50	82
	using certificates	63	55	75	100
	waste recycling	72	50	75	91
	environmentally friendly technologies	63	55	100	100

ERP – environmental and resource productivity; NWB – natural wealth base; EQL – environmental quality of life; EIPM – economic instruments and policy measures; EMS – Environmental Management Standard; EMAS – Eco-Management and Audit Scheme; SR – Slovak Republic, CR – Czech Republic

Table 5. A vision of the future of forestry and green growth in the Slovak Republic and the Czech Republic

Statement	SR (%)	CR (%)
We believe that government policies and the regulatory environment will support and motivate businesses to implement green practices.	24	14
We expect stagnation of green growth in forestry businesses.	10	4
We see forestry in full compliance with sustainability principles.	28	20
We expect increased consumer demand for sustainably produced products and greater business interest in green growth.	22	15

SR – Slovak Republic, CR – Czech Republic

to green growth. This trend highlights the perception of consumer preferences as a significant impetus for the development of sustainable practices in the sector. Regarding government policies and the regulatory environment, respondents in the Slovak Republic express slightly higher optimism in their expectations that these policies will support the implementation of green practices. This difference may reflect different legislative frameworks or specific initiatives aimed at supporting sustainability. Expectations of stagnation of green growth are low on both sides, indicating that respondents believe in the continued development of sustainability in the forestry sector.

The results of the survey provide valuable insight into the status and approach of forestry enterprises in the Slovak and Czech Republics to the implementation of green growth and sustainable practices, while providing a basic framework for conceptualising a model for the implementation of green growth indicators. The analysis showed that larger enterprises and state-owned entities show higher engagement in environmental practices, such as carbon footprint monitoring, use of renewable energy sources and implementation of environmental management. This study agrees with the statement of Hutajulu et al. (2024), who emphasise the importance of incorporating environmental aspects and technological innovations for achieving sustainable economic development. This difference may be a consequence of the greater financial and technological capabilities of these entities, which allow them to respond more effectively to environmental requirements and pressures. In contrast, smaller and non-state enterprises, especially in the Czech Republic, face constraints that make it difficult to implement more environmentally demanding measures. This statement is confirmed by the

study by Tereshchenko et al. (2023), who list eight key practices that lead to maintaining stability in green growth and sustainability issues. Despite these challenges, there is still a positive expectation regarding their adaptation to green growth, especially in connection with the increasing demand for sustainable products. This idea was confirmed by Huttmanová et al. (2023), who argue that the concept of sustainability in the context of green growth has gained emergent relevance from a scientific, social and political perspective. This trend reflects the growing importance of consumer behaviour as a stimulator for the development of sustainable practices, which can be an advantage for small businesses that adapt to this pressure effectively. Another important aspect is the different approach to environmental quality of life and economic measures. State-owned enterprises show a higher level of participation in environmental projects and regulations, while non-state-owned enterprises are more focused on economic benefits associated with cost reduction. This is discussed in Sarkodie et al. (2023), who argue that the transition of countries to green growth is an important aspect, with the level of involvement of each country becoming a significant factor. In this context, it is important to consider that environmental policies and incentives for sustainable innovation can support the wider involvement of small and private enterprises in green growth initiatives (Pangarso et al. 2022; Runtuk et al. 2023; Nohong et al. 2024). This trade-off between environmental policy and economic viability has been documented in prior research on nature conservation impacts in Slovak forestry (Kovalčík et al. 2012).

Based on the data and analyses in question, it was possible to propose a conceptual framework for a model for implementing green growth indicators

in the Slovak Republic, which takes into account diverse approaches to sustainability between state and non-state actors, as well as between small and large enterprises. This model serves as a practical framework for implementing sustainable practices in the forestry sector with the aim of maximising environmental, economic and social benefits. Based on the differences observed in the implementation of green growth indicators among state and non-state enterprises (Table 3), and between small and large enterprises (Table 4), we propose a conceptual framework tailored to the conditions of the Slovak Republic. The framework reflects sector-specific realities and includes the following applied structure:

(*i*) Segmentation of enterprises – The results show that large and state-owned enterprises are significantly more engaged in green practices. Therefore, a segmentation-based approach should be applied when designing policies or support schemes for green growth. Tailored incentives must be designed especially for small and non-state enterprises.

(*ii*) Indicator selection based on relevance – Table 3 and Table 4 demonstrate variable application of specific indicators (e.g. EMS, EMAS, renewable energy, carbon tracking). The conceptual model must therefore prioritise indicators that are both impactful and feasible, such as energy productivity, carbon footprint tracking, and eco-certification.

(*iii*) Data-driven target setting – As shown in Table 5, enterprises expect greater regulatory support and consumer demand for sustainable products. The model should include targets aligned with these expectations, such as increasing the eco-certification rate among small and medium enterprises (SMEs) or boosting the use of renewable energy in forestry by a specific percentage over five years.

(*iv*) Practical implementation tools – Based on the empirical gaps identified in the data, the framework proposes the introduction of targeted financial instruments (e.g. green vouchers, tax deductions for EMS implementation), training programs for SMEs, and guidelines for stepwise adoption of green practices.

(*v*) Monitoring and dynamic revision – With the uneven progress highlighted in the comparative results, the model must incorporate a mechanism for adaptive monitoring. This includes regular evaluation of indicator adoption rates, barriers to implementation, and updating strategies based on stakeholder feedback.

This structured framework moves beyond a general theoretical outline and is grounded in the specific conditions revealed by our empirical results. It aims to serve as a basis for public authorities, sector organisations, and enterprises in implementing green growth in Slovakia in a systematic and evidence-based manner.

CONCLUSION

Green growth represents a strategic approach to economic development that takes into account environmental sustainability, resource efficiency and innovation with the aim of minimising negative impacts on the environment.

Based on our findings, it is clear that the concept of green growth is gaining importance as a strategic approach in the field of forestry, especially in comparison between state and non-state, as well as small and large enterprises in the Slovak and Czech Republics. The results showed that large and state-owned enterprises are generally more active in implementing sustainable practices, which is due to better accessibility to resources and greater support from public policies. We also found that the issue of the future of forestry and green growth is key for many enterprises, with the majority of respondents expecting increased demand for sustainable products and believing in continued support from government policies that should motivate enterprises to further adopt ecological measures. Based on the identified differences, a draft conceptual framework for the implementation model of green growth indicators in Slovakia was created, which represents a fundamental step for the introduction of green growth indicators and sustainable practices into practice. A key challenge remains to ensure that smaller and non-state enterprises have access to appropriate incentives and support, thereby increasing their ability to respond to the demands of sustainable development.

A limitation of this research is that the comparison used to develop the conceptual framework of the model was conducted in only two countries. A possible extension to include other countries would provide a broader view of the differences and similarities in the implementation of green growth indicators, which would allow for a more

detailed specification of the model. One limitation of the dataset is the underrepresentation of certain enterprise groups, especially micro-enterprises and private non-logging services. While the sample provides a broad overview, future research should aim to ensure balanced representation across all subcategories of forestry-related enterprises.

Future research could focus on examining the long-term impact of implementing green growth indicators on the economic performance and environmental outcomes of businesses, the study of which would effectively support sustainable practices in various industry sectors.

REFERENCES

Abbas J., Sağsan M. (2019): Impact of knowledge management practices on green innovation and corporate sustainable development: A structural analysis. Journal of Cleaner Production, 229: 611–620.

Abbas S., Dastgeer G., Nasreen S., Kousar S., Riaz U., Arsh S., Imran M. (2024): How financial inclusion and green innovation promote green economic growth in developing countries. Sustainability, 16: 6430.

Acosta L.A., Maharjan P., Peyriere H., Galotto I., Mamiit R.J., Ho C., Flores B.H., Anastasia O. (2019): Green Growth Index: Concept, Methods and Applications. GGGI Technical Report No. 5. Seoul, Global Green Growth Institute: 200.

Andryeyeva N., Khumarova N., Nikolaychuk T. (2020): Aligning the social, environmental, and economic interests of 'green growth' of the Ukrainian nature reserve fund objects. Environmental Economics, 10: 93.

Baldé K., Boelens A., Brinksma E., Edens B., Hiethaar S., Klein P., Schenau S. (2011): Green Growth in the Netherlands. Hague, CBS: 55.

Bouzarovski S., Petrova S. (2015): A global perspective on domestic energy deprivation: Overcoming the energy poverty-fuel poverty binary. Energy Research & Social Science, 10: 31–40.

Cheng S., Shu C., Jin M., He Y. (2023): Balancing resources and sustainability: Analyzing the impact of mineral resources utilization on green growth. Resources Policy, 86: 104143.

Dutz M.A., Sharma S. (2012): Green Growth, Technology and Innovation. World Bank Policy Research Working Paper No. 5932. Washington, D.C., The World Bank: 47.

EEA (2015): The European Environment – State and Outlook 2015: Protecting, Conserving and Enhancing Natural Capital. Copenhagen, European Environment Agency: 212.

FinStat (2024): Databáza firiem a organizácií. Availablet at: https://finstat.sk/databaza-firiem-organizacii (in Slovak)

Green E. (2016): Report on Green Transformation in Ukraine Based on OECD Green Growth Indicators.

Guo M., Nowakowska-Grunt J., Gorbanyov V., Egorova M. (2020): Green technology and sustainable development: Assessment and green growth frameworks. Sustainability, 12: 6571.

Guštafíková T. (2011): Indikátory zeleného rastu. Národný workshop 'Smerom k zelenému rastu v podmienkach SR'. Banská Bystrica, Slovak Environment Agency: 30. (in Slovak)

Haberl H., Wiedenhofer D., Virág D., Kalt G., Plank B., Brockway P., Creutzig F. (2020): A systematic review of the evidence on decoupling of GDP, resource use and GHG emissions, part II: Synthesizing the insights. Environmental Research Letters, 15: 065003.

Hajdúchová I., Mikler C., Giertliová B. (2019): Corporate social responsibility in forestry. Journal of Forest Science, 65: 423–427.

Hajdúchová I., Dudík R., Fekiač S., Hortenská K., Neikov N. (2024): Ukazovatele zeleného rastu v Slovenskej a Českej republike. In: Hajdúchová I. (ed.): Strategické zmeny vo financovaní lesov. Zvolen, Technical University in Zvolen: 57–66. (in Slovak)

Herman K.S., Kim Y.J., Shayegh S., Xiang J. (2023): A critical review of green growth indicators in G7 economies from 1990 to 2019. Sustainability Science, 18: 2589–2604.

Hickel J., Kallis G. (2020): Is green growth possible? New Political Economy, 25: 469–486.

Hutajulu H., Tahir U., Utami E.Y., Harsono I., Yuniarti T. (2024): Green growth strategy and environmental policy integration in sustainable economic development: A review of bibliometric analysis. West Science Social and Humanities Studies, 2: 474–482.

Huttmanová E., Chovancová J., Steiner M.J., Ramharter P.M., Kočiščáková K. (2023): Through circularity towards sustainability: Assessing the progress and challenges of the circular economy in the EU and Slovakia. European Journal of Sustainable Development, 12: 366–366.

Ide T., Johnson M.F., Barnett J., Krampe F., Le Billon P., Maertens L., Vélez-Torres I. (2023): The future of environmental peace and conflict research. Environmental Politics, 32: 1077–1103.

Jansen J.C. (2013): Resource Efficiency: What Does It Mean and Why Is It Relevant? Policy Brief. Petten, ECN: 8.

Jermalavičius T., Parmak M. (2012): Towards a Resilient Society, or Why Estonia Does Not Need 'Psychological Defence'. Tallinn, International Centre for Defence Studies: 19.

Kolawole A.S., Iyiola A.O. (2023): Environmental pollution: Threats, impact on biodiversity, and protection strategies. In: Izah S.C., Ogwu M.C. (eds): Sustainable Utilization and Conservation of Africa's Biological Resources and Environment. Singapore, Springer Nature Singapore: 377–409.

Korená Hillayová M., Holušová K., Báliková K., Holécy J. (2022): Comparison of the approach to determination of the rotation period of forest stands in the Czech Republic and in the Slovak Republic. Journal of Forest Science, 68: 413–422.

Kovalčík M., Sarvašová Z., Schwarz M., Moravčík M., Oravec M., Lásková J., Tutka J. (2012): Financial and socio-economic impacts of nature conservation on forestry in Slovakia. Journal of Forest Science, 58: 425–435.

Kvasha T.K., Musina L. (2016): Report on Green Transformation in Ukraine. Kyiv, Ministry of Economic Development and Trade of Ukraine: 56.

Kwilinski A., Lyulyov O., Pimonenko T. (2023): The effects of urbanisation on green growth within sustainable development goals. Land, 12: 511.

Milligan B., Terama E., Jiménez-Aybar R., Ekins P. (2014): GLOBE Natural Capital Accounting Study. 2nd Ed. London, GLOBE International and University College London: 145.

Nohong M., Sobarsyah M., Alamzah N., Sylvana A., Herman B. (2024): Green financial management and its impact on small medium enterprises (SMEs): An empirical study in Indonesia. Journal of Environmental Assessment Policy and Management, 26: 2450001.

OECD (2011a): Green Growth Strategy. Paris, Organization for Economic Cooperation and Development: 100.

OECD (2011b): Towards Green Growth: Monitoring Progress. OECD Indicators. Paris, Organization for Economic Cooperation and Development: 145. Available at: https://www.oecd.org/content/dam/oecd/en/publications/reports/2011/05/towards-green-growth-monitoring-progress_g1g1342e/9789264111356-en.pdf

OECD (2013): Národný súbor indikátorov zeleného rastu v SR. Bratislava, Organization for Economic Cooperation and Development: 30. (in Slovak)

OECD (2014): Selected Green Growth Indicators in the Slovak Republic. Banská Bystrica, Slovak Environment Agency: 50. Available at: https://www.oecd.org/green-growth/Green%20Growth%20Indicators%20in%20the%20Slovak%20Republic.pdf

OECD (2017): Green Growth Indicators 2017. OECD Green Growth Studies. Paris, Organization for Economic Cooperation and Development: 160. Available at: https://doi.org/10.1787/9789264268586-en

Pangarso A., Sisilia K., Setyorini R., Peranginangin Y., Awirya A.A. (2022): The long path to achieving green economy performance for micro small medium enterprise. Journal of Innovation and Entrepreneurship, 11: 1–19.

Przychodzen W., Leyva-de la Hiz D.I., Przychodzen J. (2020): First-mover advantages in green innovation – Opportunities and threats for financial performance: A longitudinal analysis. Corporate Social Responsibility and Environmental Management, 27: 339–357.

Runtuk J.K., Ng P.K., Ooi S.Y., Purwanto R., Nur Chairat A.S., Ng Y.J. (2023): Sustainable growth for small and medium-sized enterprises: Interpretive structural modeling approach. Sustainability, 15: 4555.

Sarkodie S.A., Owusu P.A., Taden J. (2023): Comprehensive green growth indicators across countries and territories. Scientific Data, 10: 413.

Sarvašová Z., Pajtík J., Dobšinská Z. (2025): Understanding societal priorities for forest ecosystem services: Survey insights from 'Forestry Days 2024' in Slovakia. Journal of Forest Science, 71: 195–204.

Schenau S. (2017): Measuring green growth for environmental economic policies in the Netherlands. In: Vardon M., Bass S., Ahlroth S., Ruijs A. (eds): Forum on Natural Capital Accounting for Better Policy Decisions: Taking Stock and Moving Forward. Washington, D.C., World Bank WAVES: 131–138.

Sedliačiková M., Melichová M., Schmidtová J., Kocianová A., Stasiak-Betlejewska R. (2023): Green growth and sustainable development in the wood-processing industry: Evidence from Slovakia. Polish Journal of Management Studies, 27: 328–342.

Tereshchenko E., Happonen A., Porras J., Vaithilingam C.A. (2023): Green growth, waste management, and environmental impact reduction success cases from small and medium enterprises context: A systematic mapping study. IEEE Access, 11: 56900–56920.

UNESCAP (2012): Green Growth, Resources and Resilience: Environmental Sustainability in Asia and the Pacific. Bangkok, United Nations Economic and Social Commission for Asia and the Pacific: 135.

Vazquez-Brust D., Sarkis J. (2012): Green Growth: Managing the Transition to a Sustainable Economy. Learning by Doing in East Asia and Europe. Dordrecht, Springer: 342.

Zhang N., Gong Z., Yin K., Wang Y. (2018): Special issue 'Decision models in green growth and sustainable development'. International Journal of Environmental Research and Public Health, 15: 1093.