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Economic efficiency and finance in the development of the forest economy within the framework of legal restrictions

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Abstract. The present study aims to analyse the factors that determine the economic efficiency and optimal models of forestry financing in the context of the current legal framework. The article discusses the critical importance of forestry for global environmental sustainability and economic development. It is determined that economic efficiency in this area is to achieve the maximum economic result while minimizing costs and making optimal use of resources. The main indicators of economic efficiency are the productivity of forest resources, which depends on the ability to maintain and restore forest plantations, as well as on cost optimization, including operating costs and investments in modern technologies. Economic efficiency is also determined by financial results, including revenues from the sale of forest products and profitability of enterprises. An important aspect was the consideration of environmental and social aspects, such as the impact of forestry on ecosystems and employment. The article emphasized the role of innovative technologies, such as geographic information systems and remote sensing, in improving the efficiency of forest management. The article analyses the impact of access to financial resources, level of technological

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development, management approaches, legislative framework, environmental sustainability and market conditions on the economic efficiency of forestry in Kosovo. As a result, recommendations were made to improve the economic efficiency of forestry, including increasing financial support, attracting international investment, improving the legal framework and developing international cooperation. Implementation of these measures will contribute to the conservation and efficient use of forest resources, ensuring economic stability and environmental safety of the country

Keywords: legislative norms; resource efficiency; environmental standards; innovation; public-private partnership

Introduction

Forestry plays a key role in ensuring environmental sustainability and economic development in many countries around the world. It not only supplies important resources such as timber and other forest products, but also contributes to biodiversity conservation, climate regulation and the maintenance of ecosystem services. In the face of global challenges such as climate change, forest degradation and population growth, the issue of effective forest management and financing is becoming increasingly important.

The relevance of researching the economic efficiency and financing of forestry is due to the growing challenges associated with the conservation of natural resources and ensuring sustainable economic development. In today's climate change and increasing environmental crises, effective forest management is of particular importance. Forestry plays a pivotal role in maintaining ecosystem services, regulating the carbon balance and providing raw materials for many industries. One of the main problems is insufficient funding for the forestry sector. Many countries face a shortage of investment in forest restoration, technology modernization and infrastructure development (Baraban *et al.*, 2023). This leads to a decline in the productivity of forest resources and increased risks of their depletion. In addition, there is a problem of imperfect mechanisms for controlling and monitoring compliance with legal norms, which limits the possibility of effective forest management.

The economic efficiency of forestry depends on many factors, including access to financial resources, the level of technological development, management approaches and the legislative framework. One of the most important aspects is the introduction of innovative technologies that increase the productivity of forest resources and reduce costs. Financial management in the forestry sector includes planning, control and analysis of financial flows aimed at supporting and developing forestry. This involves the efficient use of budgetary and extra-budgetary funds, attracting investments and grants, and developing partnerships with the private sector. One of the most promising areas is the introduction of public-private partnership mechanisms, which allows attracting additional resources for forestry development. Legislation governing forestry varies from country to country and from one country to another, and from one international agreement to another (Malchyk, 2024). They may include requirements for harvesting, reforestation, biodiversity, and landscape conservation. Meeting these requirements requires additional efforts and resources from forestry enterprises, which may affect their economic efficiency.

The works of leading scientists reveal various aspects of the impact of legislative norms on the economic profitability of forestry, the role of state funding, the use of innovative technologies, the importance of public-private partnerships, the impact of international agreements and economic analysis of costs and benefits. E. Makrickiene *et al.* (2019) and H. Bekteshi (2020) analysed the impact of legislation on the economic profitability of forestry in their studies. Their research shows that strict legal restrictions can significantly reduce the profitability of forestry enterprises, while stimulating the introduction of more sustainable forest management practices. M.R. Fisher *et al.* (2019) studied the role of public funding in forestry development, arguing that adequate funding from the state is critical to maintaining sustainable forest development, while it lacks leads to degradation of forest resources and a decrease in their productivity. A. McEwan *et al.* (2020) considered the use of innovative technologies to improve the efficiency of forestry. C. Yang & H. Shang (2023) studied the impact of public-private partnerships on forestry financing and showed that such partnerships can provide additional resources for the development of the forest sector, increasing management efficiency and reducing the burden on public budgets. A. Näyhä (2019) and J. Eggers *et al.* (2020) studied the economic aspects of forest restoration after deforestation. Their work shows that investments in reforestation have long-term economic benefits, including improved ecosystem services and increased biodiversity, which in turn contributes to the economic stability of regions. F.A. Taye *et al.* (2021) reviewed the economic analysis of costs and benefits in forestry, emphasizing the importance of a detailed analysis of economic activities for making informed management decisions.

The analysis of previous studies points to various aspects of the impact of legislation, public funding, use of innovative technologies, public-private partnerships and international agreements on the economic efficiency of forestry. Various authors have concluded that adequate financing, innovation, partnerships and international commitments are important for the sustainable development of the forestry sector. However, the impact of mass industrialization and growing demand for forest resources on economic efficiency and environmental sustainability, the role of regulators in ensuring compliance with legal norms, and the assessment of risks and opportunities associated with climate change on the financial strategies of forestry enterprises remain insufficiently researched.

The purpose of the study was to reveal the relationship between economic efficiency, financing and legal restrictions in forestry. The main objectives of the study were to analyse the impact of legal restrictions on the economic efficiency of forestry, to examine the role of financing in the development of the forestry sector, and to identify possible ways to optimize costs and revenues in the context of strict legal regulations.

Materials and Methods

This study used data from various sources to provide a comprehensive analysis of the economic efficiency of forestry in Kosovo. The main data source was official reports from the Ministry of Agriculture, Forestry and Rural Development of Kosovo (2021). Also, data from national and international organizations such as the World Bank (n.d.) and the European Investment Bank (2022). The following key indicators were used for the analysis: the area of forest plantations and their distribution between the public and private sectors; financial indicators, including enterprise turnover, the number of active enterprises and the number of employees in the forestry sector; data on the planning and implementation of forest resource use plans in public and private forests;

information on the level of technological development, including the use of modern technologies such as geographic information systems (GIS) and remote sensing (RS).

Data collection included the use of official reports and statistics collected from the official reports of the Ministry of Agriculture, Forestry and Rural Development of Kosovo for the period 2019-2021. This included information on forest area, forest condition, and financial performance of forest enterprises. The data for this study was analysed until 2021, as the official reports of the Ministry did not contain complete data for later periods. The data analysis included quantitative analysis, which used descriptive statistics to analyse quantitative data such as forest area, financial indicators and forest productivity. To compare the economic efficiency between state and private forests, differences in the implementation of forest resource use plans and financial indicators between the two sectors were analysed. The level of implementation of modern technologies in forestry, such as GIS and remote sensing, was also assessed, including the impact of these technologies on the productivity and economic efficiency of forest enterprises. The activities of Geo&Land (2017) and Kosovo Forest Agency (Ministry of Agriculture Forestry..., n.d.) were analysed. The analysis included an assessment of their activities, use of modern technologies and cooperation with international organizations.

The assessment of the impact of external factors included an analysis of financial resources, legal frameworks and market conditions. The analysis of the impact of access to financial resources on the ability of forestry enterprises to modernize equipment, introduce new technologies and carry out reforestation activities was an important element. The legal framework was analysed through the Kosovo Forest Law and subsequent amendments (Law of Kosovo No. 2003/3..., 2003; Law of Kosovo No. 03/L-153..., 2010; Law of Kosovo No. 08/L-137..., 2023). This analysis encompassed an assessment of the impact of legislative changes on the effectiveness of forest management and the operations of forest enterprises. In particular, the provisions of the law aimed at protecting forests, preventing illegal logging and maintaining biodiversity were considered. The effectiveness of the control and monitoring mechanisms provided for by the law and how they affect the operations of forestry enterprises were also assessed. Particular attention was paid to changes aimed at strengthening liability for violations of forestry legislation, as well as at promoting the sustainable use of forest resources.

Results

Forestry is a critical sector that makes a significant contribution to global environmental sustainability and economic development. Economic efficiency in this context means achieving the maximum economic result while making optimal use of resources and minimizing costs. However, economic efficiency in forestry should be balanced with environmental and social aspects, which makes it a multifaceted and complex concept (Ayala-Niño & Emmet-Booth, 2022). One of the key indicators of economic efficiency is the productivity of forest resources. It refers to the quantity and quality of timber and other forest products that can be obtained from a unit area. High productivity means that forest resources are used as efficiently as possible, providing high returns at minimal costs. Productivity also depends on the ability to maintain and regenerate forests, which guarantees the long-term sustainability and productivity of forest resources. An important aspect of economic efficiency is the cost of forestry. This includes operating costs for growing, maintaining, harvesting and transporting forest products. In addition, it includes investments in the modernization of

technologies and equipment that are necessary for the efficient management of forest resources. Cost optimization is critical to improving the economic efficiency of forestry. Economic efficiency is also determined by financial performance (Chen *et al.*, 2020). This encompasses revenues from the sale of forest products and services, as well as profitability and profitability of forestry enterprises. A high financial result indicates the efficient use of resources and the success of forestry as an economic sector.

Economic efficiency in forestry cannot be considered without taking into account environmental aspects. The impact of forestry activities on ecosystems and biodiversity is an important indicator. Sustainable forest management practices and reforestation measures contribute to maintaining the ecological balance and long-term productivity of forests. Environmental sustainability is an integral part of economic efficiency, as it ensures the long-term availability of forest resources (Melaku *et al.*, 2023). Forestry also has a significant social impact. This includes creating jobs and improving the well-being of local communities, especially in rural and remote areas. The social responsibility of forestry enterprises and the involvement of local people in forest management contribute to social stability and support for environmental initiatives. Consideration of social aspects helps to ensure support for local communities and sustainable forest management (Santika *et al.*, 2019). Innovation plays a crucial role in improving the economic efficiency of forestry. The use of GIS and RS can significantly improve the efficiency of monitoring and management of forest resources. These technologies help reduce costs and improve data accuracy, which is key to effective forest planning and management. Innovative methods can optimize resource use and increase productivity, which ultimately contributes to economic efficiency (Raihan *et al.*, 2022).

The main factors affecting the economic efficiency of forestry are access to financial resources, the level of technological development, management approaches, legislative frameworks, environmental sustainability and market conditions. Access to financial resources determines the ability of forestry enterprises to make the necessary investments in equipment modernization, introduction of new technologies and forest restoration. A high level of technological development allows increasing productivity and reducing costs through the use of innovative solutions, GIS and remote sensing. Management approaches play a critical role in planning, controlling and analysing financial flows, which contributes to the efficient use of resources and informed management decisions. The legal framework, including logging requirements, reforestation and biodiversity protection measures, creates the legal environment in which forestry enterprises operate (Jhariya *et al.*, 2019). Meeting these requirements may require additional effort and resources, but it also incentivizes the implementation of sustainable forest management practices.

Environmental sustainability is an important factor that affects the long-term productivity of forest resources and the maintenance of ecological balance. Market conditions, including supply and demand for forest products, prices and competition, also have a significant impact on economic performance. Stable demand for high-quality forest products and favourable prices can provide high revenues and profits, while changes in the market can cause financial difficulties for enterprises (Santosa *et al.*, 2024). These factors together determine the opportunities and constraints for improving the economic efficiency of forestry, making their consideration essential for the sustainable development of the sector. Financing plays a key role in the forest sector, providing the necessary resources to maintain and develop

forestry enterprises. It affects all aspects of operations, from growing and caring for forests to harvesting, rehabilitation and modernization of production processes. First and foremost, adequate funding allows for investments in modern technologies that increase the productivity and efficiency of forest management. This, in turn, helps to optimize operating costs and increase overall economic efficiency. Financing is critical for forest restoration. Restoration processes, including planting new trees, caring for young forests, and protecting them from pests and diseases, require significant financial investments (Rode *et al.*, 2019). Without adequate funding, these measures may not be effective enough, leading to the degradation of forest resources and reduced productivity in the future.

Financing contributes to the development of infrastructure necessary for efficient forestry operations. This includes the construction and maintenance of forest roads, warehouses, processing plants and other facilities that ensure efficient harvesting, transportation, and processing of forest products. A well-developed infrastructure helps to reduce logistics costs and increase the profitability of enterprises. In addition, financing plays an important role in ensuring compliance with legal regulations and standards. Compliance with environmental requirements, sustainable forest management standards and international agreements requires additional financial resources. Ensuring the necessary level of financing allows companies to meet these standards, which contributes to the conservation of biodiversity and the maintenance of ecological balance. Funding is also important to stimulate research and innovation in the forest sector. Investments in research and development contribute to the development of new forest management methods, increased resource efficiency and improved environmental practices. Attracting private capital through public-private partnerships (PPPs) is another important aspect of financing. PPPs allow attracting additional resources for forestry development by sharing risks and ensuring effective project management. This helps to increase the investment attractiveness of the sector and reduce the burden on the state budget (Popoola *et al.*, 2020).

Forest cover in Kosovo covers 40.9% of the country's total land area, which demonstrates the significant role of forests in the environmental and economic context. These forests are not only a source of timber and other forest products, but also an important element of biodiversity conservation. In Kosovo, there are a total of 464,800 ha of forests, of which 60% are publicly owned by the Kosovo Forestry Administration and 40% are controlled by the private sector. However, it should be noted that the state of the country's forestry fund has its challenges: certain areas of forests have remained in fairly good condition, while others have already suffered from degradation caused by illegal logging and insufficient attention to rehabilitation. As of 2021, the turnover of forestry and logging-related enterprises was EUR 6,626 thousand. The number of active enterprises was 46, and the number of employees was 134 (Ministry of Agriculture Forestry..., 2021).

One of the key challenges for Kosovo's forestry sector is insufficient funding, which severely limits the sector's development opportunities. For example, investments in the forestry sector remain limited, which negatively affects the implementation of necessary reforestation measures. Without sufficient funding, it is difficult to implement large-scale reforestation projects, including planting new trees, caring for young plantations and protecting forests from pests and diseases. One of the reforestation projects in the Shar Planina area is facing difficulties due to a lack of funding, which is slowing down its implementation and reducing the effectiveness of the greening measures. In

addition, limited financial resources make it difficult to modernize equipment used in forestry. Many companies operate with outdated equipment, which reduces productivity and increases costs. For example, logging companies in the Pecs region use equipment that requires frequent repairs and does not meet modern standards, resulting in high logging costs (Müller *et al.*, 2023). Insufficient funding also limits opportunities for research and development of innovative forest management practices. Forestry research is critical to developing effective management strategies that can ensure the sustainable use of forest resources and increase their productivity.

The level of technological development in Kosovo's forestry sector is relatively low, which is a significant obstacle to improving the efficiency of the sector. Many forestry enterprises do not have access to modern technology. The lack of modern technology reduces productivity and increases the cost of logging and reforestation. The use of outdated methods and equipment leads to less efficient use of resources, increasing the cost per unit of production and reducing the profitability of enterprises. Management approaches in Kosovo's forestry sector need to be significantly improved to ensure its economic efficiency and sustainable development. In practice, there may be a lack of qualified personnel capable of effectively planning, controlling and analysing financial flows. The lack of proper coordination between different levels of government also hampers decision-making and the implementation of effective strategies. Table 1 shows the level of implementation of the plan for the extraction of forest resources in state-owned forests.

Table 1. Implementation of the plan for the extraction of forest resources in state-owned forests in Kosovo from 2019 to 2021

Assortment	2019			2020			2021		
	Plan, m^3	Sales, m^3	Index, %	Plan, m^3	Sales, m^3	Index, %	Plan, m^3	Sales, m^3	Index, %
Technical wood	6,292	2,721	43	7,868	2,379	30	8,481	4,322	51
Firewood	58,399	20,713	35	55,443	23,634	43	55,199	22,542	41
Waste	4,115	1,052	26	4,203	216	5	4,292	357	8
Total	68,806	24,486	36	67,513	26,229	39	67,972	27,221	40

Source: developed by the author based on the Ministry of Agriculture, Forestry and Rural Development (2021)

Analysing the data in the table, it can be seen that the implementation of the forest resource extraction plan in Kosovo is significantly below the planned level for all three categories over the three years. The best results were achieved in 2021, when the plan was implemented at 40%. These indicators indicate that there are significant challenges and problems in Kosovo's forest sector that may hinder the effective management and use of forest resources. Table 2 shows the level of implementation of the plan for the use of private forests.

Table 2. Implementation of the forest resource extraction plan in private forests in Kosovo in 2020 and 2021

District	2020			2021		
	Plan, m^3	Sales, m^3	Index, %	Plan, m^3	Sales, m^3	Index, %
Prishtina	43,540	25,842	59	43,450	21,881	50
Mitrovica	72,230	41,622	58	83,850	49,509	59

Table 2, Continued

District	2020			2021		
	Plan, m^3	Sales, m^3	Index, %	Plan, m^3	Sales, m^3	Index, %
Peja	10,400	2,348	23	4,580	3,758	82
Prizren	4,190	2,297	55	3,960	2,530	64
Ferizaj	10,900	5,773	53	10,900	5,220	48
Gjilan	58,260	53,576	92	44,800	57,396	128
Gjakova	750	283	38	750	295	39
Total	200,180	131,742	66	192,290	140,589	73

Source: developed by the author based on the Ministry of Agriculture, Forestry and Rural Development (2021)

Table 2 shows that the level of plan implementation in Kosovo's private forests varies considerably between districts. The best results were achieved in Gielansky district, where the plan implementation rate was 92% in 2020 and 128% in 2021, exceeding the planned targets. This reflects effective management and monitoring in this district. The worst performance was in Djakovitsky district, where plan implementation was only 38% and 39%, indicating serious problems or constraints that could have prevented the achievement of the targets. Overall, there was an improvement in plan implementation in 2021 compared to 2020, which may be the result of adaptation to previous challenges or improved conditions in the private forestry sector. It is also worth noting that the overall implementation of the harvesting plan in the country's private forests significantly exceeds the implementation of the plan in state forests, both in 2021 and 2020.

The legal framework for forestry in Kosovo is underdeveloped, which poses significant challenges for the conservation and sustainable use of forest resources. Existing laws and regulations often do not adequately protect forests from illegal logging and other forms of illegal activities. For example, the Law of Kosovo No. 03/L-153 "On Amending and Supplementing the Law No. 2003/3 On Kosovo Forests" (2010) and subsequent amendments and supplements, although aimed at regulating forestry activities, has several shortcomings in ensuring effective control over the use of forest resources. The imperfection of legal mechanisms for control and monitoring of compliance with legal norms also limits the possibilities for effective forest management. For example, the responsibility for controlling forest resources is often dispersed among different authorities, leading to insufficient coordination and duplication of efforts. This is evident in the case of the Kosovo Environmental Protection Agency, which lacks the resources to conduct regular inspections and monitor forest conditions.

Illegal logging remains one of the most serious threats to Kosovo's forests. The lack of effective legal mechanisms to combat this problem leads to significant losses of forest resources. Despite the existence of the Criminal Code of the Republic of Kosovo (2019), which provides for punishment for illegal deforestation, in practice, the application of these norms is limited. A lack of qualified inspectors and insufficient funding to conduct proper investigations make the fight against illegal logging ineffective. For example, in the Shar Planina region, illegal logging remains a serious problem despite numerous attempts by the authorities to introduce stricter controls (Pandurska-Dramikjanin, n.d.). International legislation that affects forestry in Kosovo includes various conventions and agreements, including the Convention on Biological Diversity (1992)

and the UN Convention to Combat Desertification (1994). Kosovo is also striving to meet European Union (EU) standards as part of its European integration process, which includes the adaptation of national legislation to EU requirements in the field of environmental protection and sustainable management of natural resources. However, the development of the legal framework is hampered by a lack of adequate cooperation with international organizations and programmes that could provide the necessary knowledge and resources to improve legislation. For example, Kosovo's participation in the EU European Green Deal (2019) programme could help to develop more effective legal mechanisms and introduce best practices in forest management.

Enterprises must invest in reforestation after harvesting, which includes planting new trees, caring for young plantations, and protecting them from pests and diseases. This places an additional financial burden on companies, especially given the limited funding available in this sector. In addition, the requirements for forest certification to meet international standards such as the Forest Stewardship Council (FSC) require companies to incur additional costs for certification procedures and compliance monitoring. This can be particularly difficult for smaller enterprises with limited financial resources. The Kosovo Forest Agency (KFA) (Ministry of Agriculture Forestry..., n.d.) is a state-owned enterprise responsible for the management of state forests in Kosovo. Their tasks include forest protection, combating illegal logging, reforestation, and ensuring sustainable use of forest resources (Law of Kosovo No. 08/L-137..., 2023). As a state-owned enterprise, KFA is funded mainly from the state budget, which ensures stability but also limits the scope for significant investments in modernization and development. The economic efficiency of the agency is enhanced by international assistance programmes and cooperation with other government agencies. KFA provides employment for the local population, especially in rural areas where other opportunities are limited. The agency also conducts educational programmes on environmental protection and sustainable use of resources, which helps to raise environmental awareness among the population.

The KFA is governed by national legislation and international agreements, such as the United Nations Framework Convention on Climate Change (1992). These legal constraints oblige the agency to adhere to strict environmental protection standards, which often increase costs and make it difficult to respond quickly to challenges. For example, legal requirements to protect biodiversity and restore forests may impose additional financial burdens on the agency. However, compliance with these standards is essential to ensure sustainable development and preserve ecological balance. One of the examples of KFA's successful activities is their participation in reforestation projects funded by international organizations. These projects include planting new trees, combating soil erosion and creating protective forest belts. These initiatives not only improve the condition of forests but also ensure the long-term environmental sustainability of the region. Cooperation with international partners allows KFA to attract the necessary resources and expertise, which contributes to the efficiency of their activities.

Geo&Land (2017) is a private company in Kosovo that specializes in providing geoinformation services and implementing the latest technologies in various sectors, including forestry. The main tasks of the company are monitoring of forest resources, support of forest management and environmental management. The use of GIS and remote sensing will allow the company to conduct a detailed analysis of the state of forests, track changes in ecosystems, and respond quickly to illegal

logging. The company provides services not only to government agencies, but also to private enterprises, which contributes to revenue diversification and a stable financial position. The use of innovative approaches allows Geo&Land to reduce costs and increase productivity, which has a positive impact on economic development. Legal constraints and regulatory mechanisms also have a significant impact on Geo&Land's operations. These constraints include requirements for the conservation of forest resources, regulations on the use of geographic information systems and remote sensing, and mandatory environmental reporting and monitoring standards (Law of Kosovo No. 08/L-137..., 2023). Like other companies in Kosovo's forestry sector, Geo&Land must comply with national legal requirements and international standards, particularly those related to environmental protection and sustainable forest management. The existing legal framework may limit the company's ability to implement some innovations due to the additional costs of regulatory compliance. However, the same framework ensures the protection of forest resources, which in the long run contributes to the sustainable development of forestry in the country.

Several recommendations were made to improve the economic efficiency and finance of forestry development within the legal constraints. To ensure sustainable development of the sector, the government should increase financial support and introduce targeted subsidies. For example, the government of Kosovo could introduce grants for forestry enterprises to upgrade equipment and technologies needed for efficient and environmentally friendly harvesting. Such subsidies could also be used to support reforestation programmes for forests affected by illegal logging. Attracting international investment is critical to overcoming financial constraints in Kosovo's forestry sector. Cooperation with international organizations such as the World Bank, the European Investment Bank and the Food and Agriculture Organization (FAO) can provide access to additional financial resources. In addition, public-private partnerships (PPPs) can significantly improve the financing and management of forest resources. Public-private cooperation programmes facilitate investment and increase the efficiency of forest management. The Kosovo government should create an enabling environment for PPPs by developing appropriate legislation and regulatory mechanisms. This includes the introduction of tax incentives for companies investing in forestry. Joint projects with private investors could include the construction of new timber processing plants or the modernization of existing ones, which would increase the productivity and economic efficiency of the forestry sector.

To increase the economic efficiency of forestry, it is necessary to improve the methods of planning and cost control. For example, the use of route planning and resource allocation software can help reduce the time and cost of transporting timber from the forest to processing facilities. Furthermore, the introduction of cost control systems will help identify areas where savings can be made. Increasing productivity is another key aspect of improving the economic efficiency of forestry. The introduction of new methods of logging and wood processing will increase production and reduce waste. For example, the use of modern logging equipment, such as high-performance logging machines, will significantly increase the speed and efficiency of operations, while reducing labour and fuel costs. Creating conditions for the development of ecotourism will generate additional revenue and increase the attractiveness of forest areas for visitors. For instance, the development of additional hiking trails and recreation areas will help attract tourists. Kosovo's forestry

legislation should be subjected to a comprehensive review to meet modern requirements and industry needs. Simplifying licensing procedures and developing more flexible regulations is a step forward in facilitating the business environment for the forestry sector. For instance, an automated online application system could be introduced to replace complex and time-consuming licensing procedures, which would simplify access to licensing procedures for forestry enterprises. The use of modern technologies, such as geographic information systems and satellite sensing, will allow for more accurate and timely monitoring of changes in forest cover. The creation of an electronic timber accounting system will increase transparency and control over logging, preventing illegal activities (Coops *et al.*, 2021). Strengthening accountability and introducing incentives for compliance with the law can have a positive impact on the economic efficiency of the forestry sector. Tax breaks or subsidies can be provided to companies that comply with the environmental management of forest resources or implement environmentally friendly technologies.

The introduction of a forest certification system based on international standards, such as FSC, is critical to promoting sustainable forest management. FSC certification not only increases the environmental responsibility of companies, but also makes Kosovo's forest products more competitive on international markets. Developing cooperation with international environmental and forestry organizations, such as the FAO and the World Bank, can provide access to new knowledge, technology, and financing. Joint projects and initiatives will help Kosovo implement best practices in forest management. Improving the economic and financial performance of forestry development in Kosovo requires a comprehensive approach. The introduction of modern technologies, improvement of the legal framework, attraction of investments and international cooperation are key steps to achieve sustainable development. Implementation of these recommendations will contribute to the conservation and efficient use of forest resources, ensuring economic stability and environmental safety of the country.

Discussion

The results of the study indicate the importance of forestry for Kosovo's economy and environment, but the challenges that exist significantly limit the sector's effectiveness. Covering 40.9% of the country's territory, forests are not only a source of timber and other forest products, but also an important element of biodiversity conservation and environmental sustainability. Despite its considerable potential, insufficient funding and outdated technology pose serious obstacles to the industry's development. With this in mind, it is important to understand how to use the available resources more efficiently and what steps need to be taken to overcome the existing problems. In his paper, K.M. Mattor *et al.* (2020) focused on the study of specific methods of forest management, such as the development of forest ecosystem management strategies or the implementation of effective forest monitoring and assessment systems. R.P. Acharya *et al.* (2019) also studied the impact of different management practices on biodiversity conservation, reforestation after deforestation, and wildfire management. Compared to the current study, which places more emphasis on balancing economic efficiency with environmental and social aspects, the authors' work is aimed at greater optimization of management processes and improving the efficiency of internal operations.

One of the key aspects of economic efficiency is the productivity of forest resources, which depends on the ability to maintain and regenerate forest plantations (Kerimkhulle *et al.*, 2023). Data shows that the implementation

of harvesting plans is significantly below the planned level, indicating problems in the management and use of resources. For example, in state forests, the plan implementation rate was only 40% in 2021, indicating the need to improve planning and control of forestry operations. It also points to potential problems with logistics, insufficient coordination between different levels of government, and a possible lack of adequate funding. C. Ammer (2019) also studied the productivity of forest resources, with a focus on analysing the impact of anthropogenic impacts on the natural balance of ecosystems. Similarly, C. Li *et al.* (2020) conducted research aimed at studying how deforestation, land use change, and other human activities affect the productivity of forest ecosystems. The authors' results include an analysis of the growth and development of forest stands under the influence of various factors, such as air pollution, climate change and other anthropogenic factors. Compared to the current results, which also examine the productivity of forest resources, the authors' research shows the impact of human activity on ecological processes in forests. They highlighted that anthropogenic factor has a significant impact on the productivity of forest ecosystems, which may differ from a more technical analysis.

Financing is a critical factor for ensuring effective forest management. The results show that insufficient funding limits the ability to carry out necessary reforestation activities and equipment upgrades. Reforestation projects face difficulties due to lack of funding, which slows down their implementation and reduces the effectiveness of measures. Enterprises use outdated equipment, which leads to high logging costs. Insufficient funding also hinders research, which is essential for developing new methods of forest management and increasing productivity. P.K. Bhandari *et al.* (2019) also noted that financing is a key factor for forestry development. R.P. Chudy & F.W. Cubbage (2020) pointed out that efficient use of resources and attraction of investments can have a positive impact on the economic productivity of the sector. Their study emphasized that without adequate funding, it becomes difficult to implement the necessary reforms and modernization. The authors highlighted financing as a key factor that can have a significant impact on the economic productivity of forestry. This is in line with current findings, which also highlight the importance of financing for achieving sustainable development of the sector.

The social aspect also plays an important role in forestry. Creating jobs and improving the well-being of local communities are important factors that contribute to social stability and support for environmental initiatives (Yatsiv *et al.*, 2024). However, the study shows that there is often a lack of coordination between different levels of government, which complicates decision-making and the implementation of effective strategies. Insufficient coordination between local and central governments in planning forestry activities leads to delays in project implementation and low efficiency of forest management measures. H.F. Kaufman & L.C. Kaufman (2019) studied the impact of forestry on local communities and social stability, with a focus on analysing the relationship between forest resources and local livelihoods. The authors studied the impact of forests on providing jobs and income to local residents through logging companies and other forestry enterprises. The authors pointed to the need to create jobs in rural areas through forestry development and relationships with local communities, which was not addressed in the current study. Environmental sustainability is an integral part of the economic efficiency of forestry. Illegal logging remains one of the most serious threats to Kosovo's forest resources. Despite the existence of legal provisions such

as the Criminal Code of the Republic of Kosovo (2019), the lack of qualified inspectors and limited funding make the fight against illegal logging ineffective. J. Oettel & K. Lapin (2021) focused on researching the impact of forestry on environmental sustainability and biodiversity conservation. He studied the ecosystem services provided by forests, such as soil conservation, air and water purification, and climate regulation. In contrast to the current results, which focused on the ecological aspects of forestry, the author's research is more focused on the conservation of the natural environment and ecosystems, as well as on factors that affect biodiversity conservation.

Innovation and modern technology can significantly improve the economic efficiency of forestry. The use of GIS and remote sensing can improve data accuracy and reduce the cost of monitoring and managing forest resources. However, the level of technological development in Kosovo's forestry sector is relatively low, which hinders efficiency gains. Many enterprises do not have access to modern technology, which reduces productivity and increases the cost of harvesting and reforestation. C. Gollob *et al.* (2020) also focused on the use of modern technologies in forestry and their impact on increasing productivity and reducing costs. The authors investigated the effectiveness of technologies such as geographic information systems and remote sensing. In turn, J. Călina *et al.* (2020) studied drones, automated control systems, data analytics, and other innovative solutions. The authors analysed how these technologies can facilitate forest management processes, ensure the accuracy and speed of data collection and processing, and help solve various forest management tasks. The authors studied mainly the technological aspects of forestry, but it is also worthwhile to cover various areas such as economic efficiency, social responsibility and environmental sustainability in forestry.

In general, forestry is a complex system in which economic, environmental and social aspects are interconnected and interdependent. It is important to balance these aspects to achieve sustainable development of the sector. The results of the study confirm the need to increase funding, use effective management practices, introduce modern technologies and take into account the needs of local communities in the process of forest management. Additional research and practical measures can help improve forestry efficiency and ensure sustainable use of forest resources in the future.

Conclusions

Forestry is a key sector that plays a crucial role in ensuring environmental sustainability and economic development. The study showed that economic efficiency in forestry involves achieving maximum economic output while optimizing resource use and minimizing costs. However, in order to achieve this efficiency, it is important to ensure a balance between economic, environmental and social aspects. One of the key aspects of economic efficiency is the productivity of forest resources. It is determined by the quality and quantity of timber and other forest products that can be obtained from a unit area. Ensuring high productivity is important for ensuring the sustainability and efficient use of forest resources. Another important aspect of economic efficiency is the costs associated with forestry, including operating costs and investments in modernization of technologies and equipment.

The study also confirmed that the economic efficiency of forestry cannot be considered separately from environmental and social aspects. It is important to ensure the sustainable use of forest resources and the preservation of ecological balance, as well as to create favourable conditions for the development of local communities and improve their well-being. The

overall performance of forestry also depends on financial resources, technological development, management approaches, legislation, environmental sustainability and market conditions. It is necessary to ensure financing, the use of modern technologies and improved management approaches to increase the economic efficiency of forestry. Forestry in Kosovo plays an important role in ensuring environmental sustainability and economic development. Given the large forest area in Kosovo – 40.9% of the country's total area – forests are a key element of the ecosystem and play an important role in biodiversity conservation. One of the key challenges for forestry in Kosovo is the lack of funding, which significantly limits the sector's development. For example, investments in forestry remain limited, which negatively affects the implementation of the necessary reconstruction and reforestation works. The study also found that the level of technological development in the forestry sector in Kosovo is relatively low, which is a significant obstacle to improving the efficiency of the sector. Many forestry enterprises do not have access to modern technologies.

The recommendations for improving the economic efficiency of the forestry sector include measures to increase financial support, develop innovations and modern technologies, improve management approaches and the legal framework, and attract international resources and cooperation. Their implementation will contribute to the sustainable development of forestry in Kosovo and ensure economic stability and environmental security of the country. It is important to develop an integrated approach to forest management to ensure the sustainable use and economic sustainability of the sector. A limitation of the study is the lack of up-to-date data and the inability to conduct a detailed analysis. For further research, it is recommended to extend the analysis to other aspects of forestry, in particular, to focus on the social impact and environmental consequences of forestry activities. It is also important to conduct a detailed study of the effectiveness of innovative technologies in forestry and their impact on economic productivity.

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Conflict of Interest

The authors of this study declare no conflict of interest.

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Економічна ефективність і фінанси в розвитку лісового господарства в рамках правових обмежень

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Анотація. Метою даного дослідження є аналіз факторів, що визначають економічну ефективність та оптимальні моделі фінансування лісового господарства в контексті чинної законодавчої бази. У статті обговорюється критичне значення лісового господарства для глобальної екологічної стійкості та економічного розвитку. Визначено, що економічна ефективність у цій сфері полягає в досягненні максимального економічного результату при мінімізації витрат та оптимальному використанні ресурсів. Основними показниками економічної ефективності є продуктивність лісових ресурсів, яка залежить від можливості підтримувати та відновлювати лісові насадження, а також від оптимізації витрат, у тому числі експлуатаційних витрат та інвестицій у сучасні технології. Економічна ефективність визначається також фінансовими результатами, зокрема виручкою від реалізації лісопродукції та рентабельністю підприємств. Важливим аспектом було врахування екологічних і соціальних аспектів, таких як вплив лісового господарства на екосистеми та зайнятість. У статті підкреслено роль інноваційних технологій, таких як геоінформаційні системи та дистанційне зондування, у підвищенні ефективності управління лісами. У статті аналізується вплив доступу до фінансових ресурсів, рівня технологічного розвитку, підходів до управління, законодавчої бази, екологічної стійкості та ринкових умов на економічну ефективність лісового господарства в Косово. За результатами надано рекомендації щодо підвищення економічної ефективності лісового господарства, зокрема збільшення фінансової підтримки, залучення міжнародних інвестицій, удосконалення законодавчої бази та розвитку міжнародного співробітництва. Реалізація цих заходів сприятиме збереженню та ефективному використанню лісових ресурсів, забезпеченню економічної стабільності та екологічної безпеки країни

Ключові слова: законодавчі норми; ефективність використання ресурсів; екологічні стандарти; інноваційність; державно-приватне партнерство