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Sustainability Transition and Perceived Competitiveness of Forest-Sector SMEs in Lithuania: Interactions Between Regulation, Sustainable Product Development and Human Resources

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Abstract

Small and medium-sized enterprises (SMEs) in the forest sector face increasing sustainability requirements, regulatory changes and technological development. These changes create new opportunities but also increase operating costs, uncertainty and the need for new competences. This study aims to assess the importance of regulation and sustainability requirements, sustainable product development and human resources for the competitiveness of forest-sector SMEs in Lithuania, and to examine the relationships between these factors. The analysis was based on an online survey of 40 experts representing 40 Lithuanian forest-sector enterprises. The questionnaire included 106 statements covering strengths, weaknesses, opportunities and threats (SWOT), assessed using a five-point Likert scale. The data were analysed using descriptive statistics, the Friedman test, Bonferroni-adjusted pairwise comparisons and exploratory regression analysis. The results showed that regulation and sustainability requirements were perceived as both opportunities and constraints. Increased operating costs were the highest-rated regulatory weakness (mean = 4.48), while improved consumer reputation was the highest-rated regulatory strength (mean = 4.30). Technological progress was identified as an important opportunity for sustainable product development. Access to European Union and national funding programmes was the highest-rated perceived driver of competitiveness, while regulatory and policy constraints were the highest-rated barrier. Regression analysis revealed positive associations between perceived weaknesses and opportunities, suggesting that experts who recognised greater internal limitations also tended to identify external opportunities. These relationships should not, however, be interpreted as causal effects. Overall, the findings indicate that regulatory conditions, access to finance, technological development and human resources are closely related dimensions of the sustainability transition. Their interaction may influence how forest-sector SMEs adapt to changing requirements and strengthen their long-term competitiveness. The findings reflect the situation of forest-sector SMEs in Lithuania, based on expert assessments, and provide insights into the factors shaping their competitiveness during the sustainability transition.

Keywords: forest-sector SMEs; perceived competitiveness; sustainability transition; strengths; weaknesses; opportunities and threats (SWOT); regulation; sustainable product development; human resources

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1. Introduction

In recent years, the European forest sector has faced increasing change driven by climate policy, biodiversity objectives, growing sustainability requirements and the need to use natural resources more efficiently. These developments affect not only forest management but also the operating conditions of forest-sector SMEs. The New EU Forest Strategy for 2030 stresses the need to strengthen forest protection and resilience while maintaining the social and economic functions of forests and supporting a sustainable forest-based bioeconomy [1]. The EU bioeconomy strategy follows a similar direction. It links the bioeconomy not only to environmental objectives, but also to competitiveness, investment, innovation, more efficient use of biological resources and the development of markets for bio-based products. It also highlights the economic importance of primary producers and rural areas [2]. For forest-sector SMEs, these changes involve more than new environmental requirements. They also affect investment, production technologies, raw material use, certification, new product development and employee competences. The ability to adapt to the sustainability transition is therefore increasingly linked to long-term competitiveness. Previous studies show that transformation in the forest sector is a complex process. Näyhä [3], examining Finnish forest-sector SMEs, showed that development is shaped not only by new products but also by resource use, business models and a changing business environment. Näyhä [4] further showed that the transition towards a circular bioeconomy depends not only on technological solutions, but also on organisational capabilities, human resources, a flexible organisational culture, communication and the ability to anticipate market and societal needs. The sustainability transition can also create new business opportunities. D'Amato et al. [5], analysing circular bioeconomy business models in Finnish forest-based small and medium-sized enterprises, identified renewable resources, technological innovation and collaboration as important elements. At the same time, they showed that implementation depends on enterprises' ability to respond to business challenges and create and retain economic value. Regulation is another important part of this transition. New requirements can encourage innovation, more efficient resource use and new operating models, but they can also increase adaptation costs and uncertainty. Falcone et al. [6], using SWOT analysis in the Italian forest sector, showed that the transition towards a sustainable bioeconomy depends on both internal capacities and external institutional and economic conditions. Their study also highlighted the role of policy measures, infrastructure, innovation and new forest-based value chains. Ladu et al. [7] likewise showed that the transition towards a circular forest bioeconomy cannot be linked to a single policy measure. Their results indicate that environmental, climate, research and sustainable forest management policies need to be considered as a policy mix. The operating environment of enterprises therefore depends not only on individual legal requirements, but also on how different policy measures work together. Human resources are equally important. Technological and regulatory change increases the need not only to retain traditional forestry and wood production knowledge, but also to develop new competences. Almanza Floyd et al. [8] highlighted the importance of human resource management in linking sustainability and competitiveness in the paper industry, particularly through the social dimension of sustainability. Their findings suggest that the sustainability transition requires attention not only to technologies and production processes, but also to employee-related organisational practices.

Näyhä [4] showed that human and other intangible organisational resources are important for companies moving towards new bioeconomy business models. Employee competences and the capacity to update them can therefore be considered important conditions for adaptation. Previous research has examined forest bioeconomy, circular economy, sustainability, business models, regulation and competitiveness, but these issues are often analysed separately. Most studies identify individual drivers, barriers or organisational

resources, while less attention has been paid to how regulation and sustainability requirements, sustainable product development and human resources interact from the perspective of enterprises. The relationships among strengths, weaknesses, opportunities and threats have also received less attention than the individual factors themselves. SWOT analysis provides a structured way to assess internal and external factors. In the forest sector, it has been used to analyse the transition towards a sustainable bioeconomy and to identify major drivers and barriers [6]. However, conventional SWOT analysis is mainly descriptive. A remaining methodological gap is the limited quantitative assessment of relationships among SWOT dimensions and of how these dimensions are associated with perceived competitiveness drivers and barriers. This study addresses this gap by combining a SWOT framework with rank-based and regression analyses. The aim was to assess factors related to regulation and sustainability requirements, sustainable product development and human resources that are important for the competitiveness of forest-sector SMEs and to identify relationships between these factors. The study therefore examines not only the relative importance of individual SWOT factors, but also relationships among SWOT dimensions and their associations with perceived competitiveness drivers and barriers. Taken together, this literature suggests that sustainability-related competitiveness should be examined through the interaction of institutional conditions, sustainable product development and organisational capabilities. The Lithuanian forest-sector context provides an opportunity to assess how enterprise managers perceive these interrelated conditions.

This study therefore focuses on three interrelated areas: regulation and sustainability requirements, sustainable product development and human resources. The research aims to identify and assess the relative importance of strengths, weaknesses, opportunities and threats (SWOT) within these areas and to examine their relationships with perceived drivers and barriers to competitiveness. The analysis is guided by two exploratory propositions: (P1) perceived internal strengths and weaknesses are associated with perceived external opportunities and threats; and (P2) relationships between SWOT factors and perceived competitiveness drivers and barriers extend across the three areas. These propositions are examined on the basis of expert assessments and do not imply causal relationships or directly measured changes in enterprise performance.

2. Materials and Methods

Primary data were collected in spring 2026 through an online survey of managers of enterprises operating in the Lithuanian forest sector. A total of 75 enterprise managers were invited to participate, and 40 completed questionnaires were included in the analysis, representing a response rate of 53.3%. Each expert represented a different enterprise. The main eligibility criterion for experts was at least 5 years of professional experience in the forest sector. The survey was designed to obtain assessments from managers with practical knowledge of enterprise operations, sustainability requirements and competitiveness-related challenges.

The enterprises were selected using purposive, criteria-based sampling to ensure diversity in their operational and organisational characteristics. The main selection criteria included: (1) involvement in forestry, forest management, timber harvesting or closely related forest-sector activities; (2) active operation in Lithuania; (3) geographical location; (4) enterprise size; (5) legal form; and (6) length of operational experience. These criteria were applied to include enterprises with different characteristics and to reflect the diversity of businesses operating in the Lithuanian forest sector. A similar approach to identifying the characteristics of forest-sector SMEs was applied in previous research [9].

The questionnaire consisted of two main parts. The first included questions describing the characteristics of the enterprises represented by the experts. The second focused on

three areas considered important for the competitiveness of forest-sector SMEs: regulation and sustainability requirements, sustainable product development and human resources.

The three analytical areas were selected based on an earlier expert assessment conducted within the Interreg Europe project FBI4EU—Policies to Promote the Competitiveness of Forest-Based SMEs in Resource-Efficient European Regions. In this preceding stage, 35 experts assessed the main challenges facing enterprises in the Lithuanian forest sector, particularly those related to sustainability policies, changing market requirements and workforce competences. The findings of this assessment provided the basis for selecting the three areas examined in the present study. The questionnaire included 106 statements developed using the findings of the preceding expert assessment and organised according to the strengths, weaknesses, opportunities and threats (SWOT) framework. The questionnaire was designed to assess the perceived importance of internal and external factors affecting enterprise competitiveness. Strengths and weaknesses were classified as internal factors, while opportunities and threats represented external conditions. Experts assessed each statement using a five-point Likert scale, ranging from 1 (not important at all) to 5 (very important). The questionnaire also included statements concerning the perceived drivers and barriers of competitiveness. No separate pilot survey was conducted; the preceding expert assessment informed questionnaire development but did not provide independent psychometric validation of the final instrument.

SWOT analysis was used to identify and structure factors associated with the competitiveness of forest-sector SMEs. This method provides a framework for examining internal organisational characteristics and external conditions affecting enterprise activities. However, conventional SWOT analysis is primarily descriptive and does not provide a statistical assessment of the relative importance of individual factors. To address this limitation, SWOT analysis was combined with quantitative statistical methods. Phadermrod et al. [10] demonstrated that quantitative approaches can support the prioritisation of SWOT factors and strengthen their application in strategic analysis. Figure 1 presents the research design and the main stages of the statistical analysis.

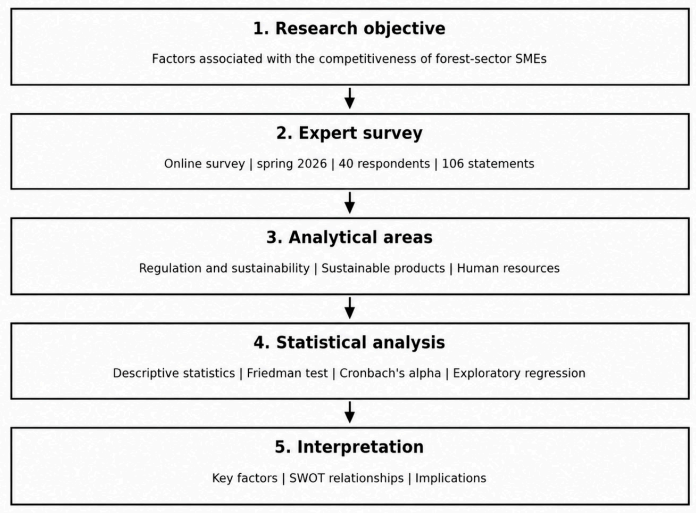


Figure 1. Research design and analytical framework.

The statistical analysis was conducted using IBM SPSS Statistics 29.0. Descriptive statistics were first calculated to examine the distribution of experts' assessments and the relative importance of individual statements. These included frequencies, percentages, medians, modes and arithmetic means. Mean values were used as descriptive indicators to facilitate comparisons between the assessed factors.

Differences between the ratings of statements within each SWOT dimension were examined using the Friedman test. This non-parametric method was selected because the same experts assessed several related statements using an ordinal scale. The distinction between individual ordinal Likert items and aggregated multi-item scales is important because different statistical approaches may be appropriate for these two types of measures [11]. The test was applied separately to the relevant groups of statements within the three analytical areas. The null hypothesis assumed that there were no statistically significant differences between the ratings of statements within the same group. Where the Friedman test indicated significant differences, Bonferroni-adjusted pairwise comparisons were conducted to identify differences between individual statements. Kendall's coefficient of concordance (W) was calculated to assess the magnitude of the differences. Statistical significance was set at $p < 0.05$.

Before conducting regression analysis, the internal consistency of the questionnaire scales was assessed using Cronbach's alpha. Reliability was evaluated separately for strengths, weaknesses, opportunities and threats within each analytical area, as well as for the scales representing perceived drivers and barriers of competitiveness. Composite indicators were calculated as the arithmetic means of the corresponding questionnaire items. These indicators were used to represent experts' assessments of each SWOT dimension and the perceived drivers and barriers of competitiveness. Cronbach's alpha was used to assess internal consistency, recognising that it does not independently establish the validity or unidimensionality of the constructed indicators.

Multiple linear regression analysis was used to examine selected associations between the composite SWOT indicators and the perceived drivers and barriers of competitiveness. The primary specifications were defined according to the research objective and covered regulation and human resources, cross-domain internal weaknesses, and the relationship between weaknesses and opportunities. Other domain-specific and cross-domain specifications were retained as supplementary exploratory analyses rather than treated as independent confirmatory tests. Each model included the same 40 observations. The full set of additional models and their diagnostics is documented in Supplementary Tables S1–S3.

Associations between SWOT dimensions were examined using the conceptual logic of the TOWS framework [12]. The main text emphasises selected weaknesses–opportunities (W–O) relationships; additional strengths–opportunities (S–O), strengths–threats (S–T) and weaknesses–threats (W–T) models are reported in the Supplementary Materials. Although individual Likert items are ordinal, methodological research indicates that parametric approaches to rating-scale data may be appropriate under suitable conditions [13]. Standardised regression coefficients (β) were used to describe the direction and relative magnitude of partial associations [14].

Regression models used the mean-based composite indicators described above. R^2 and adjusted R^2 were used to describe in-sample model fit. Variance inflation factors (VIFs), residual and influence statistics, and bias-corrected and accelerated (BCa) bootstrap confidence intervals based on 5000 resamples were reviewed where available. Given the small sample, multiple model specifications and potential correlations between predictors, coefficients were interpreted as exploratory, non-causal associations rather than independently validated predictions.

Overall, the methodological approach combined quantitative SWOT assessment, non-parametric statistical tests and exploratory regression analysis. This approach allowed the relative importance of competitiveness-related factors to be assessed and the relationships between regulation and sustainability requirements, sustainable product development and human resources to be examined within a common analytical framework.

3. Results

3.1. Scale Reliability

Before composite indicators were used, the internal consistency of the scales was assessed. Cronbach's alpha values were high across all three areas. For regulation and sustainability requirements, subscale values ranged from 0.819 to 0.936; for sustainable products, from 0.861 to 0.941; and for human resources, from 0.842 to 0.929 (Table 1). The overall scales for the three areas also showed very high internal consistency ($\alpha = 0.958–0.967$). Cronbach's alpha was 0.941 for the competitiveness drivers scale and 0.929 for the barriers scale.

Table 1. Internal consistency of the scales.

Area/Scale	Strengths α	Weaknesses α	Opportunities α	Threats α	Overall α
Regulation and sustainability requirements	0.835	0.819	0.906	0.936	0.958
Sustainable products	0.904	0.861	0.941	0.881	0.967
Human resources	0.875	0.921	0.929	0.842	0.963
Perceived competitiveness drivers	–	–	–	–	0.941
Perceived competitiveness barriers	–	–	–	–	0.929

The Cronbach's alpha coefficients indicate high internal consistency of the scales. However, these coefficients do not establish their dimensional structure or construct validity. The composite indicators were therefore used as exploratory summary measures in the subsequent regression analysis.

3.2. Assessment of Regulation and Sustainability Requirements

The assessments of regulation and sustainability requirements reflected both potential benefits and constraints for forest-sector enterprises. Experts attached importance to improved reputation and opportunities for modernisation, while also identifying the additional costs and operational difficulties associated with meeting sustainability requirements.

Experts identified improved reputation among consumers as the highest-rated regulatory strength (M = 4.30); 85.0% rated this factor as important or very important (Table 2). Encouraging investment in innovation and production modernisation was also rated highly (M = 4.15; 80.0%). The implementation of green policy incentives received a more moderate rating (M = 3.40). The Friedman test showed statistically significant differences among the regulatory strengths, $\chi^2(6) = 48.381$, $p < 0.001$, Kendall's W = 0.202. Pairwise comparisons showed that improved reputation and support for innovation were rated significantly higher than the implementation of green policy incentives, and both were also rated higher than the competitive advantage associated solely with compliance with stricter environmental standards.

The highest-rated regulatory weakness was increased operating costs (M = 4.48; Md = 5), rated as important or very important by 95.0% of experts. A high financial burden (M = 4.30), complex compliance requirements (M = 4.28) and a higher risk of penalties (M = 4.25) were also rated highly. The Friedman test showed statistically significant differences among the weaknesses, $\chi^2(9) = 48.932$, $p < 0.001$, Kendall's W = 0.136. Increased operating costs were rated significantly more important than limited technical knowledge, limited access to funding instruments and limited short-term returns. Among the opportunities associated with regulation, gaining a competitive advantage received the highest rating (M = 4.23; 87.5% important or very important). Opportunity ratings differed significantly, $\chi^2(8) = 36.462$, $p < 0.001$, Kendall's W = 0.114. Competitive advantage was rated significantly higher than the adoption of new circular-economy models

and certification and labelling as a means of entering new markets. For regulatory threats, experts focused mainly on the direct consequences of new requirements. The highest ratings were given to operational disruptions during the implementation of new requirements (M = 4.23), the risk of fines and sanctions (M = 4.20), higher production costs in the short term (M = 4.15), and uncertainty surrounding new standards and requirements (M = 4.05). Threat ratings differed significantly, $\chi^2(12) = 54.179$, $p < 0.001$, Kendall's W = 0.113. Pairwise comparisons showed that operational disruptions were rated significantly more important than the risk of being accused of greenwashing.

Table 2. Highest-rated SWOT factors by area.

Area	SWOT Dimension	Highest-Rated Factor	Mean	Important/Very Important, %	Friedman Test
Regulation	Strengths	Improved reputation among consumers	4.30	85.0	$\chi^2(6) = 48.381$; $p < 0.001$
Regulation	Weaknesses	Increased operating costs	4.48	95.0	$\chi^2(9) = 48.932$; $p < 0.001$
Regulation	Opportunities	Competitive advantage	4.23	87.5	$\chi^2(8) = 36.462$; $p < 0.001$
Regulation	Threats	Operational disruptions during implementation of new requirements	4.23	87.5	$\chi^2(12) = 54.179$; $p < 0.001$
Sustainable products	Strengths	Product differentiation	3.75	67.5	$\chi^2(3) = 1.841$; $p = 0.606$
Sustainable products	Weaknesses	High production costs	4.20	87.5	$\chi^2(3) = 16.775$; $p < 0.001$
Sustainable products	Opportunities	Technological progress	3.95	77.5	$\chi^2(6) = 17.432$; $p = 0.008$
Sustainable products	Threats	Uncertainty caused by changing environmental requirements	4.30	85.0	$\chi^2(6) = 40.699$; $p < 0.001$
Human resources	Strengths	Traditional forestry and wood-production knowledge	4.13	90.0	$\chi^2(4) = 25.950$; $p < 0.001$
Human resources	Weaknesses	Difficulty competing for qualified employees	4.08	82.5	$\chi^2(5) = 7.964$; $p = 0.158$
Human resources	Opportunities	Distance and e-learning platforms	3.83	75.0	$\chi^2(5) = 20.905$; $p < 0.001$
Human resources	Threats	Economic instability	4.15	87.5	$\chi^2(4) = 14.853$; $p = 0.005$

3.3. Assessment of Sustainable Product Development

Ratings of the four sustainable product development strengths did not differ significantly. Accordingly, differences between their descriptive mean values should not be interpreted as statistically established priorities. Product differentiation had the highest descriptive mean among sustainable product development strengths (M = 3.75). However, the Friedman test did not identify significant differences between the four items, $\chi^2(3) = 1.841$, $p = 0.606$, Kendall's W = 0.015. The results therefore do not identify a statistically distinct leading strength.

Among the weaknesses of sustainable products, high production costs (M = 4.20; 87.5%) and resource shortages (M = 4.10; 80.0%) were rated most highly. The Friedman test showed a significant overall difference among weakness ratings, $\chi^2(3) = 16.775$, $p < 0.001$, Kendall's W = 0.140. However, Bonferroni-adjusted pairwise comparisons did not

identify significant differences between specific pairs. Thus, costs and resource shortages stand out descriptively, but the other constraints on sustainable product development also remain important.

Among opportunities for sustainable product development, technological progress that can reduce costs and improve resource-use efficiency received the highest rating (M = 3.95). It was followed by collaboration with larger companies (M = 3.83) and access to funding for sustainable product development (M = 3.78). The overall difference among opportunity ratings was statistically significant, $\chi^2(6) = 17.432$, $p = 0.008$, while Kendall's W was 0.073, indicating limited differentiation among the ratings. Pairwise comparisons did not confirm significant differences.

Among threats to sustainable product development, the highest-rated factor was uncertainty caused by changing environmental requirements (M = 4.30; 85.0%). This was followed by the risk of greenwashing (M = 4.05) and the cost and complexity of certification (M = 4.00). The Friedman test showed significant differences among threat ratings, $\chi^2(6) = 40.699$, $p < 0.001$, Kendall's W = 0.170. Regulatory uncertainty was rated significantly higher than increased competition arising from demand for sustainable products and barriers to technology adoption.

3.4. Human Resources

In the area of human resources, traditional forestry and wood-production knowledge and practical skills received the highest rating among the human resource strengths (M = 4.13; 90.0%). The role of sustainability and eco-innovation in attracting employees received the lowest rating (M = 3.45). Strength ratings differed significantly, $\chi^2(4) = 25.950$, $p < 0.001$, Kendall's W = 0.162; traditional professional knowledge was rated significantly higher than the attractiveness created by sustainability and eco-innovation.

Difficulty competing with financially stronger enterprises for qualified employees received the highest mean rating among human resource weaknesses (M = 4.08; 82.5% rated it important or very important). However, differences among the six weaknesses were not statistically significant, $\chi^2(5) = 7.964$, $p = 0.158$, Kendall's W = 0.040. Thus, the observed ranking should be treated as descriptive rather than evidence that one weakness was significantly more important than the others.

In the assessment of human resource opportunities, the highest mean ratings were assigned to distance and e-learning platforms (M = 3.83), support for employee competence development and collaboration with research and training institutions (both M = 3.80). The overall Friedman test was significant, $\chi^2(5) = 20.905$, $p < 0.001$, while Kendall's W was 0.105, indicating limited differentiation among the ratings. Pairwise comparisons did not reveal significant differences.

Among human resource threats, economic instability received the highest rating (M = 4.15; Md = 4); 87.5% of experts considered it important or very important. Technological skills gaps among employees and high employee turnover received the same mean rating (M = 3.80), while employee resistance to change was rated slightly lower (M = 3.75). The mean rating for a shortage of highly qualified employees was 3.70. The overall difference among the five threat ratings was statistically significant, $\chi^2(4) = 14.853$, $p = 0.005$, Kendall's W = 0.093, but no significant pairwise differences remained after Bonferroni adjustment.

3.5. Overall Comparison of SWOT Priorities

The overall comparisons across the three analytical areas identified several highly rated factors. Improved consumer reputation had the highest mean rank among strengths (11.29), increased operating costs among weaknesses (13.84), competitive advantage

among opportunities (15.31), and uncertainty associated with changing environmental requirements among threats (16.59). All four Friedman tests were statistically significant ($p < 0.001$), although Kendall's W values were relatively low (0.096–0.118), indicating modest differentiation across the assessed factors.

3.6. Competitiveness Drivers and Barriers

Experts identified regulatory and policy constraints—complex business regulation, bureaucratic procedures and frequent policy changes—as the highest-rated perceived barrier to competitiveness (mean rank = 6.88) (Table 3). This was followed by strong market competition (6.14), limited access to European Union or national funding (5.98), and labour-market challenges (5.84). The Friedman test also showed significant differences among the barriers, $\chi^2(9) = 40.811$, $p < 0.001$, Kendall's W = 0.113. Regulatory and policy constraints were rated significantly more important than gaps in innovation and research and development (p_adj = 0.002).

Table 3. Main perceived drivers and barriers to the competitiveness of forest-sector SMEs.

Category	Highest-Rated Factor	Mean Rank	Friedman Test	Most Important Pairwise Difference
Drivers	Access to EU and national funding programmes	6.84	$\chi^2(9) = 37.309$; $p < 0.001$	Higher than investment in innovation and R&D; p_adj = 0.018
Barriers	Regulatory and policy constraints	6.88	$\chi^2(9) = 40.811$; $p < 0.001$	Higher than gaps in innovation and R&D; p_adj = 0.002

3.7. Relationships Between SWOT Dimensions and Perceived Competitiveness Barriers and Drivers

Selected models showed associations between perceived competitiveness barriers and SWOT dimensions (Table 4). In the regulation-specific model, regulatory threats were positively associated with perceived barriers ($\beta = 0.672$; $p < 0.001$) (Table 5). In the human resources model, both weaknesses ($\beta = 0.463$; $p = 0.005$) and threats ($\beta = 0.586$; $p < 0.001$) were associated with barriers. These estimates represent within-sample associations rather than evidence that the identified factors caused the reported barriers.

Table 4. Summary of statistically significant associations between SWOT dimensions and perceived competitiveness drivers and barriers.

Area Analysed	Dimensions Significantly Associated with Barriers	Dimensions Significantly Associated with Drivers
Regulation	Threats	Opportunities and threats
Sustainable products	No significant coefficient in the four-predictor domain model; supplementary alternative models differed	Opportunities
Human resources	Weaknesses and threats	Weaknesses and threats
Internal factors from all areas combined	Human resource weaknesses	Sustainable product and human resource weaknesses
External factors from all areas combined	Regulatory and human resource threats	Regulatory and sustainable product opportunities

Note: The table combines associations from different exploratory model specifications; the significance of individual coefficients is conditional on the predictors included. Results from additional model specifications are presented in Supplementary Table S1. Statistical significance does not imply a causal relationship.

Table 5. Selected exploratory regression models of competitiveness-related factors and relationships between SWOT dimensions.

Model	Significant Predictor(s)	β (*p*)	R^2	Adj. R^2	F
Perceived barriers—regulation	Regulatory threats	0.672 (<0.001)	0.800	0.777	35.06 ***
Perceived barriers—human resources	Human resource weaknesses; human resources threats	0.463 (0.005); 0.586 (<0.001)	0.815	0.794	38.59 ***
Perceived drivers—regulation	Regulatory opportunities; regulatory threats	0.505 (<0.001); 0.513 (<0.001)	0.893	0.881	72.94 ***
Perceived drivers—all internal factors	Sustainable product weaknesses; human resource weaknesses	0.330 (0.044); 0.430 (0.003)	0.843	0.814	29.49 ***
W–O: regulatory opportunities	Sustainable product weaknesses; human resource weaknesses	0.552 (0.006); 0.347 (0.030)	0.712	0.688	29.69 ***
W–O: sustainable-product opportunities	Sustainable product weaknesses; human resource weaknesses	0.400 (0.011); 0.548 (<0.001)	0.821	0.806	54.86 ***

Note: β = standardised regression coefficient; R^2 = in-sample coefficient of determination; adjusted R^2 accounts for model size; F = overall regression model F-statistic; *** $p < 0.001$ (overall model significance). Only coefficients significant in the conventional model are displayed. Complete model coefficients, VIF values, bootstrap BCa confidence intervals and influence diagnostics are provided or source-referenced in Supplementary Tables S1–S3. Statistical significance alone does not establish coefficient stability or predictive validity.

For perceived competitiveness drivers, the regulation-specific model identified positive associations with regulatory opportunities (β = 0.505; $p < 0.001$) and regulatory threats (β = 0.513; $p < 0.001$). The corresponding 5000-resample bootstrap BCa confidence intervals for the unstandardised coefficients excluded zero (0.201–0.951 and 0.227–0.840, respectively). These results suggest that managers who attached greater importance to regulatory opportunities and threats also gave higher ratings to perceived competitiveness drivers.

In the selected model combining internal strengths and weaknesses across all three areas, sustainable product weaknesses (β = 0.330; $p = 0.044$) and human resource weaknesses (β = 0.430; $p = 0.003$) were positively associated with perceived competitiveness drivers (Table 5). This six-predictor model accounted for 84.3% of the observed variation in the perceived drivers composite within the sample (adjusted $R^2 = 0.814$). Given correlated predictors and the small sample, these coefficients should be interpreted cautiously. Other exploratory specifications are summarised in Supplementary Table S1.

3.8. Relationships Among SWOT Dimensions

The strategy-oriented analyses identified relationships among internal and external SWOT assessments. The primary analysis focuses on weaknesses–opportunities (W–O) associations, as these directly address the proposed relationships between perceived internal constraints and external opportunities. The broader S–O, S–T and W–T results are summarised in Supplementary Table S2.

Within each analytical area, higher ratings of weaknesses were associated with higher ratings of opportunities in the corresponding area: regulation ($R^2 = 0.444$; β = 0.667; $p < 0.001$), sustainable product development ($R^2 = 0.717$; β = 0.847; $p < 0.001$) and human resources ($R^2 = 0.681$; β = 0.825; $p < 0.001$). These simple models provide supplementary context for the cross-domain analysis and should not be interpreted as evidence that weaknesses generate opportunities.

In the selected multivariable W–O models, regulatory opportunities were associated with sustainable product weaknesses ($\beta = 0.552$; $p = 0.006$) and human resource weaknesses ($\beta = 0.347$; $p = 0.030$; $R^2 = 0.712$). Sustainable product opportunities were associated with sustainable product weaknesses ($\beta = 0.400$; $p = 0.011$) and human resource weaknesses ($\beta = 0.548$; $p < 0.001$; $R^2 = 0.821$). These patterns suggest that assessments of internal constraints and potential opportunities frequently co-occur across the three areas; they do not imply causal direction. A summary of additional SWOT models is included in Supplementary Table S2; the complete coefficient vectors are not reproduced there.

The additional S–O, S–T and W–T models were used to assess the consistency of cross-domain SWOT associations. Although several coefficients were statistically significant, some model specifications showed predictor overlap or influential observations. These findings are presented as supplementary exploratory results (Supplementary Tables S2 and S3) rather than as independent evidence of enterprise-level performance effects.

The additional diagnostic evidence is summarised in Supplementary Table S3. In the three-predictor W–O models, VIF values were 2.912, 4.498 and 2.937. Some other specifications displayed higher multicollinearity and potentially influential observations. Although bootstrap confidence intervals were calculated for a number of coefficients, respondent-level case-deletion sensitivity analyses could not be verified from the available aggregate SPSS outputs. Consequently, the regressions are presented as exploratory in-sample associations, not as independently validated predictive models.

4. Discussion

The expert assessments indicate that perceived competitiveness-related conditions span regulation, sustainable product development and human resources. New sustainability and environmental requirements can create additional opportunities, but they also increase adaptation costs and uncertainty. The main issue is therefore not whether the sustainability transition creates benefits or costs, but under what conditions enterprises are able to manage both.

The regulatory area showed this dual role most clearly. Improved reputation among consumers and encouragement of investment in innovation and production modernisation were among the main strengths. At the same time, increased operating costs, complex compliance requirements, the risk of penalties, operational disruptions and uncertainty surrounding changing requirements were important weaknesses and threats. Regulation may therefore be perceived as encouraging change and strengthening market position, while also increasing adaptation costs.

Technological progress should be interpreted as a conditional rather than automatic opportunity. For an SME, the potential gains from digitalisation or more resource-efficient production depend on complementary investments, managerial capacity, employee skills, financing and predictable policy conditions. Our descriptive survey does not measure technology adoption rates or identify which enterprises subsequently achieved higher productivity; it identifies the importance experts attach to this potential pathway.

Falcone et al. [6] reported a similar pattern in their analysis of the Italian forest sector's transition towards a sustainable bioeconomy. Their study showed that sectoral transformation depends not only on internal capacities but also on external institutional conditions, policy measures, infrastructure and the development of innovative forest-based value chains. This is consistent with our results, in which regulatory and policy constraints were rated as the main barrier to competitiveness, while regulatory uncertainty and operational disruptions were among the highest-rated threats.

The positive weaknesses–opportunities relationships can also be interpreted within the TOWS strategic management framework [12]. In that approach, recognising internal

limitations is a starting point for identifying external opportunities and potential adaptive responses. Experts who are more alert to financing, skill or production constraints may simultaneously recognise more opportunities for support, collaboration or technological improvement. This is a plausible interpretive mechanism, not a tested explanation of the positive correlations and not evidence that weaknesses themselves generate opportunities.

Costs were one of the clearest findings. Increased operating costs were the highest-rated regulatory weakness, and high production costs also stood out in the sustainable products area. This suggests that the acceptability of the sustainability transition for enterprises depends strongly on its economic feasibility. Husgafvel et al. [15] reported similar issues in their study of circular economy development in the Finnish forest sector, linking this transition to material and energy use, public steering measures and sustainability-driven competitive advantage.

Sustainability requirements were not viewed solely as an additional burden. Competitive advantage was the highest-rated regulatory opportunity, while access to external funding ranked first among perceived competitiveness drivers. These assessments suggest that financial and technological resources may be important for enterprises seeking to benefit from sustainability-related change, consistent with the discussion of sustainability-driven competitive advantage by Husgafvel et al. [15].

In sustainable product development, the results indicate that competitiveness depends less on a single product characteristic than on the wider conditions in which products are developed. Sustainable product strengths were rated similarly, while production costs, resource shortages and uncertainty caused by changing environmental requirements stood out more clearly among weaknesses and threats. Technological progress that can reduce costs and improve resource-use efficiency was rated most favourably among opportunities. Näyhä [3] similarly showed that sectoral transformation is complicated by a complex business environment and questions surrounding the allocation of biomass and other resources. More recent evidence from Finnish wood-based SMEs also shows that technological capabilities alone may not be sufficient: networking, business-model fit and the wider sectoral regime can constrain the scaling of higher-value circular solutions [16]. Sustainable product development should therefore be viewed as the result of interacting technological, economic and regulatory conditions.

Human resources also stood out as a distinct and cross-cutting dimension. Experts rated traditional forestry and wood production knowledge and practical skills as the highest-rated strength in this area. Economic instability was the highest-rated human resource threat, while difficulty competing for qualified employees was the highest-rated weakness. This pattern shows that accumulated professional experience remains an important basis for competitiveness, but retaining and renewing this knowledge is becoming more difficult. Recent research on forest-sector employment similarly points to increasing demand for broader work-readiness, intellectual and meta-skills alongside job-specific forestry competences [17].

The selected regression results point to associations involving regulatory threats and human resource weaknesses and threats in the ratings of competitiveness barriers. Related cross-domain models also suggest that assessments of human resource and sustainable product weaknesses accompany perceived drivers of competitiveness. These findings support an integrated interpretation while remaining specific to the observed managerial assessments and selected model specifications.

The W–O results further suggest that higher ratings of internal weaknesses tend to accompany higher ratings of external opportunities, including across analytical areas. This co-occurrence does not establish a causal mechanism; additional models and diagnostics are reported in the Supplementary Materials.

The analysis of perceived competitiveness drivers and barriers also produced a clear pattern. Access to funding programmes was the highest-rated driver, while regulatory and policy constraints were the highest-rated barrier. These findings complement one another: the ability of enterprises to invest in transition depends on support instruments, but their effect may be limited by a complex and changing regulatory environment. Recent reviews of regional forest bioeconomy transitions likewise emphasise the importance of adequate economic incentives and institutional conditions for market entry and implementation [18].

Certification produced a more nuanced result. Although certification and labelling can help enterprises enter new markets, these opportunities were rated more moderately than direct competitive advantage or improved reputation. Tuppura et al. [19] similarly found that forest certification motives were more often linked to external market requirements than to regulation itself. This suggests that the value of certification becomes clearer to enterprises when it is directly linked to customer requirements, market access or a specific economic benefit.

The findings point to several practical directions. The effectiveness of policy measures depends not only on their objectives, but also on whether enterprises have sufficient time, financial resources and competences to implement new requirements. Funding instruments are also relevant for employee competence development, sustainable product development and collaboration with research and training institutions, not only for technology acquisition. At the same time, the sector needs to retain accumulated professional knowledge while developing new technological, sustainability, data-related and market competences.

Overall, the findings are consistent in many respects with previous European forest-sector studies, but they also show close relationships between regulation, sustainable products and human resources. These perceptions do not establish the effectiveness of any particular measure. Regulatory stability, access to finance, technological progress and employee competences need to be considered together.

Limitations and Future Research

This study has several methodological and empirical limitations. The non-probability sample of 40 managers representing distinct Lithuanian forest-sector enterprises limits the statistical generalisability of the findings. Furthermore, the results reflect managerial perceptions rather than objectively measured enterprise productivity, profitability or environmental performance.

The regression analyses were based on composite means derived from ordinal Likert-scale responses, requiring caution in interpreting the results [20,21]. Multiple exploratory models, correlated predictors and influential observations may affect coefficient stability, as indicated by elevated variance inflation factors and Cook's distance values in certain specifications. High in-sample R^2 values should therefore not be interpreted as independently validated predictive accuracy. Moreover, the cross-sectional design does not allow causal relationships to be established. Although bootstrap procedures were used to assess coefficient uncertainty, they do not eliminate limitations associated with sampling and model selection.

Future research should involve larger and more diverse enterprise samples, combine managerial assessments with objective economic and environmental performance indicators, and examine the reliability of composite indicators and model stability using independent datasets. Alternative approaches, including ordinal regression for individual Likert-scale outcomes, could also be considered [22]. Such research would provide a stronger basis for understanding the relationships between regulation, sustainable product development, human resources and perceived enterprise competitiveness.

5. Conclusions

The study identified interconnected factors that Lithuanian forest-sector enterprise managers perceived as important for competitiveness during the sustainability transition. Regulation and sustainability requirements were associated in experts' assessments with opportunities for improved reputation and innovation, but also with additional costs and uncertainty. Technological development was recognised as an opportunity for sustainable product development, while financial and workforce-related constraints remained important.

Human resources represented an important area of perceived strengths and constraints. Traditional forestry and wood-production knowledge received high ratings, while difficulties in attracting qualified employees and economic instability were among the challenges highlighted. The exploratory regression models suggested associations between regulatory and human resource SWOT assessments and perceived competitiveness drivers or barriers, but they cannot establish causal relationships.

Access to European Union and national funding programmes was the highest-rated perceived driver of competitiveness, whereas regulatory and policy constraints were the highest-rated perceived barrier. Positive associations between perceived weaknesses and opportunities suggest that managers who identified internal constraints also tended to recognise external opportunities. These results describe relationships within the surveyed managers' assessments.

Overall, the findings provide evidence about perceived competitiveness-related factors among the 40 Lithuanian forest-sector enterprises represented in this study. They support considering regulatory conditions, access to finance, technological development and employee competences together when discussing the sustainability transition, while not establishing objective enterprise-performance effects or generalisable patterns across European forest-sector SMEs.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/su182110779/s1: Table S1, Additional exploratory regression models examining associations between SWOT dimensions and perceived competitiveness drivers and barriers; Table S2, Additional exploratory regression models examining relationships between SWOT dimensions; Table S3, Regression diagnostics and sensitivity considerations, including variance inflation factors (VIFs), Cook's distance and bootstrap confidence intervals.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The summary findings are presented in the article and its Supplementary Materials. Requests for access to the underlying questionnaire data may be directed to the corresponding author, subject to applicable confidentiality and data protection requirements.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

SME/SMEs	Small and medium-sized enterprise(s)
EU	European Union
R&D	Research and development
SPSS	Statistical Package for the Social Sciences
SWOT	Strengths, weaknesses, opportunities and threats
TOWS	Threats, opportunities, weaknesses and strengths
S-O	Strengths–opportunities
S-T	Strengths–threats
W-O	Weaknesses–opportunities
W-T	Weaknesses–threats

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