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FOREST COMPLEX MANAGEMENT: FROM AN INTEGRATED SCORECARD SYSTEM TO A STRATUM MODEL

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Abstract

The article shows the theoretical and methodological foundations of improving the balanced scorecard system as a way to manage and implement the strategy of adaptive development of the forest complex and companies. The initial basis for modifying the balanced scorecard models is an adaptive or co-evolutionary strategy for the development of forest complex facilities. The elements of this strategy are the goal - the level of the socio-ecological and economic development of the facility; the object is a forest complex (wood industry company); goal-oriented subsystem as a system of strategic initiatives; the supporting subsystem, creating favorable conditions for the implementation of the strategy, are the parameters of the two proposed models. In the integrated model, an adequate description of the strategy occurred due to the construction of a new balanced scorecard format. In the stratum model, the modification of the classical format of the balanced scorecard system took place due to the selection of social, ecological and economic subsystems of indicators or strata in each projection. An innovative position in the proposed models of the balanced scorecard was an integral assessment of the parameters of sustainable development, both by calculating group estimates in projections and by calculating a generalized integral assessment. The methods of integrating the estimates were the fuzzy set method and the hierarchy analysis method. The magnitude of the integral socio-ecological-economic assessments reflected the level of sustainable development of objects and, along with the parameters of the dynamics of development, was the basis for constructing positioning matrices.

Keywords: Strategic management, adaptive development, forest complex, balanced scorecard system, integrated, stratum model of balanced scorecard system

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1. Introduction

The modern forest complex of our country and especially multi-forest regions is still characterized by a low level of economic efficiency of management, a weak degree of integrated and multi-purpose use of forest resources and insufficient socialization of forest relations (Kolesnichenko et al., 2019; Pankratova, 2019) (Table 1).

Table 1. Productivity and efficiency comparison of country forest complex (For base RF indicators were taken)

Indicator	Russia	Canada	Sweden	Finland
Forest covered area, million hectares	**1**	0,34	0,03	0,03
Forest area per person, hectares	1	**1,80**	0,55	0,78
Stock on 1 hectare of operational wood, cubic meters	1	**1,08**	0,92	0,70
Removal of round wood from 1 hectare, cubic meters	1	4,8	15,5	**16,9**
Removal of lumber from 1 hectare, cubic meters	1	10,0	18,1	**29,2**
Removal of paper and board with on 1 hectare, ton	1	18,0	94,0	**128**
Share of the world market for pulp and paper industry, %	1	**8,8**	5,5	4,5
Foreign exchange revenue, billion dollars	1	**7,9**	3,64	3,03

In this regard, improving the conceptual framework for strategic management of sustainable development of the forest complex means taking into account the interests of all its participants and developing adequate management mechanisms based on the principles of consistency, balance, synchronicity, multi-dimensionality, etc. (Petrov & Morkovina, 2019; Rezanov, 2015) It should be emphasized that we differ in adaptive management forest management, which is associated with the improvement of the regulatory system (Walter, 1986) and the adaptive development of forest management, which is based on the principle of coevolution as adaptation synthesis and adaptation (Rezanov, 2015).

2. Problem Statement

Strategic management of sustainable or adaptive forest management (the forest complex in the broad sense of the word) assumed an unambiguous formalization of target designation, a system of goals and the construction of an integral indicator of forest management performance. Due to the dual socio-economic and silvicultural and ecological nature of the forest, the complexity and multi-functionality of forest resources, the solution to the problem of building a single indicator of performance and efficiency shifted towards a system of criteria and indicators for sustainable forest management. While building a set of criteria and indicators, it was based on its compliance with the requirements of sustainable development and proceeded from the principles of consistency, normativity, hierarchy, differentiation, etc**.** (Rezanov, 2015). The criteria for sustainable forest management reflected the formalized requirements for the parameters of the socio-economic and bioeconomic subsystems but did not sufficiently describe the content of forest policy and adaptive strategies for the sustainable development of the forest complex. The system of criteria and indicators was complex, overloaded with indicators and at the same time some indicators had little information. It was primarily intended for certification purposes, which predetermined their

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environmental and tactical nature, greater emphasis on forestry and forestry and taxation aspects, only a general assessment of forest management systems for compliance with sustainable development requirements. For purposes of strategic management, they were not suitable, it was necessary to choose methods of strategic management that were more adequate to the requirements and principles of sustainable development. The latter necessitated the formation of a set of qualitative criteria for assessing the conformity of strategic management methods to the paradigm of sustainable development. Among these criteria, we singled out the following:

1) co-evolutionary development;
2) differentiated management;
3) cause-effect relationships;
4) formalization of the forecast state of the socio-ecological-economic system;
5) socialization of relationships.

The comparison of tools and methods of strategic management (controlling, total quality management, voluntary certification, balanced scorecard), analysis of its strengths and weaknesses allowed us to identify the balanced scorecard system (BSS) as one of the effective methods to ensure the adaptive development of the forest complex and its companies (Rezanov, 2015; Rezanov et al., 2019). Thus, the need for a more systematic understanding of the sustainable development of the forest complex, defined by us as a balanced socio-ecological-economic development, the urgent need to ensure balance and consistency of the processes and interests of forest relations participants, the sequence of filling the concept of lean and adaptive production with sustainable development requirements, determined the feasibility of using balanced scorecard system as a leading management tool for adaptive development of the forest complex and model formalization of a system of socio-ecological-economic objectives of management in our forests.

3. Research Questions

The subject of the article is the balanced scorecard as a tool of strategic management of sustainable development of economic systems, which allows to structure and link the system of goals, formalize them through strategic key performance indicators and carry out an integral development assessment.

4. Purpose of the Study

The purpose of the article is to generalize the experience of two models of the balanced scorecard in relation to the forestry complex, its companies and its internal divisions. The peculiarity and difference of these models of the balanced scorecard from the classical format is the integral assessment of the level of sustainable development and social, environmental and economic projections or strata.

5. Research Methods

The methodological basis of the study are general scientific research methods (analysis, synthesis, analogies, comparisons, etc.), system and matrix approaches, methods of fuzzy sets and analysis of hierarchies.

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6. Findings

The methodical foundations of the balanced scorecard system are the mission, values, vision, strategy and its implementation. Virtually all approaches or models distinguish the same elements: perspectives or perspectives are key aspects of the activity; strategic objectives - elements of the strategy that describe the achievement of the mission of the object; strategic indicators - reflect the key success factors and actions necessary to achieve the goals of the strategy; reference or target indicators - quantitative measurement of the desired (planned) indicator level; strategic map - a systemogram representing a causal relationship between factors and indicators of a strategy; action plan or strategic initiatives - a system of program or project measures to achieve the goals. In our opinion, a balanced scorecard should be considered not only as a way of assessing and controlling, but also forming an organizational culture and acting as an integrated management system (Kaplan & Norton, 2008). The formation of a balanced scorecard model suggested a comparison of known approaches to its creation, as well as a certain adaptation to the features of the objects (the forest complex and the timber industry company). At the same time, the approaches of Kaplan and Norton (2008), Fridag and Schmidt (2006), Rampersad (2006) were additionally considered. The centralized approach of Kaplan and Norton (2008) and the decentralized Fridag and Schmidt (2006) were defined by us as classical approaches laying the foundations of the balanced scorecard. The main differences between the approaches to building a balanced scorecard are the number and types of key aspects of activities (projections); in the development of strategies by forest relations participants; in the implementation of «bottom-up» or «top-down» principles when decomposing the balanced scorecard; algorithms for building strategic maps, as well as in the presentation of strategic initiatives– in the form of programs, projects or megaprojects.

The comparison of the main approaches to the construction of the balanced scorecard system model showed that classical approaches (Fridag-Schmidt and Kaplan-Norton models) meet the greatest demands of sustainable development, it is on their basis that our ideas about the balanced scorecard in the forest complex were formed. Further simulation of the general model of the forest complex and the forest industry company consists in adapting classical models to the characteristics of the forest complex. Firstly, this meant ensuring that our balanced scorecard system model matches the elements of the adaptive-offensive (co-evolutionary) strategy of the forest complex and meant that it should clearly reflect the common goal, an object, a goal-implementing system (a goal system and a set of measures) and a supporting system. Secondly, it was necessary to substantiate the format of the model, that is, to determine the projections and contain the key aspects of the business. In this case, we considered two options for the presentation of the format of the balanced scorecard system. The first version meant significant changes in the classic format of the balanced scorecard system, relied on the traditional consideration of the forest complex as a social, ecological and economic subsystem and assumed the allocation of analogous projections in the balanced scorecard system. The second option was implemented for a timber company, the balanced scorecard of which was a modification of the projections of the classical model (Kaplan-Norton) and the filling of each perspective with social, ecological, economic subprojections or strata of goals and indicators. As in the integrated model in the stratum model, we distinguished the perspective: «potential», in which indicators

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were presented that reflect the prerequisites for the implementation of the strategy, including the degree of improvement in management methods.

The balance and consistency of key performance indicators was ensured based on the analysis of user requirements; determine the suitability of indicators; interpretation of information; justification of the number of indicators; forming a working context. The key performance indicators must meet certain requirements (Eckerson, 2007): the number should not be large; they must objectively reflect the phenomenon; it should be simple and clear; it must be balanced, etc. The target value of the key performance indicators was the desired state of the indicator. Moreover, its values were determined on the basis of industry benchmarking, as well as analysis of the best foreign forest practices. The most important addition to the concept of a balanced scorecard was the integral assessment of indicators, which, unlike classical models, made it possible to determine the level of sustainable development and to carry out the positioning of objects by constructing appropriate matrices. In the integrated balanced scorecard system model of the forest complex, integrated assessment was based on the provisions of corporate governance, measurement of indicators based on group assessment, identification of indicators of the level of sustainability and development as the main indicators, use of the fuzzy set method (Rezanov et al., 2019). In the strategic model of the balanced scorecard system of a forestry company, a comprehensive assessment of the sustainable development of the company was carried out on the basis of the priority analysis method and included the determination of normative or reference values of target indicators and their comparison with the actual values of the indicators; recognition of equivalence and equivalence of indicators of each projection and calculation on the basis of the arithmetic average of integrated indicators of the adaptive company development (Table 2).

Table 2. Stratum model of balanced scorecard: an integrated assessment of the level of sustainable development of a forestry company (Rezanov et al., 2019)

Projection	Subprojection or strata	Coefficient of sustainable development	Group indicator sustainable development	Integrated indicator sustainable development
Environment	Economic	89,33	109,63	
	Social	96,42		
	Ecological	143,13		
Finance	Economic	96,56	99,85	
	Social	104,40		
	Ecological	98,62		
Internal processes	Economic	109,19	119,37	108,04
	Social	105,55		
	Ecological	143,37		
Potential	Economic	117,20	103,32	
	Social	96,60		
	Ecological	96,17		

In the final part of the methodological constructions of the balanced scorecard, objects were positioned based on the sustainability-development matrix and the content of strategic initiatives to ensure the necessary level of sustainable development of the forest complex and its companies was justified.

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The first main result of our research is the formation of a general concept of a balanced scorecard based on the paradigm of sustainable development and an adaptive offensive or co-evolutionary strategy for the sustainable development of the forest complex and its subjects. The content of the general model of the balanced scorecard system in line with the co-evolutionary strategy means that it reflects a common goal, ensuring the sustainable development of the forest complex and the company; the object is represented - the forest complex and its subjects with their peculiarities of functioning; purpose-oriented subsystem - which includes social, environmental and economic goals; providing subsystem (projection potential) - as a set of measures, more precisely, management mechanisms and methods that create favorable conditions for the functioning of the goal-oriented subsystem.

The second result is a consistent reflection of the elements of the co-evolutionary strategy in the balanced scorecard format. In the integrated model, this was realized by constructing a new format of the balanced scorecard system, namely: social, forestry-ecological and economic projections or views were highlighted. In the stratum model of the traditional format of the classical balanced scorecard system, in the framework of key activities, we distinguished subsystems or strata that reflect social, environmental, and economic aspects.

The allocation of such sub-projects fully corresponds to the content of the forest complex and its subjects as socio-ecological and economic systems. Both versions of the description of key activities in the forest complex by means of appropriate projections and strata adequately reflect the meaning of the adaptive-offensive strategy.

The third result is an integrated assessment of the indicators of the balanced scorecard system, which is completely new to the concept of a balanced scorecard; hence the name integrated model. The integral assessment of the parameters of sustainable development was carried out both by calculating group estimates in projections and by calculating a generalized integral assessment. The methods of integrating the estimates were the fuzzy set method and the hierarchy analysis method. The magnitude of the integrated socio-eco-economic and economic assessments reflected the level of sustainable development of objects and, along with the parameters of the dynamics of development (growth rate), was the basis for constructing positioning matrices. That is, the integral assessment in both models included the formation of key performance indicators taking into account the features of management in the forest sector and in the context of the requirements of sustainable socio-ecological and economic development, the method of integration and the equivalence of projections, as well as the positioning matrix. The allocation of strata in the balanced scorecard system model will allow, along with a systematic, integrated approach, to implement and differentiate management of adaptive development of objects, that is, to assess the degree of development and contribution of social, ecological and economic subsystems of objects.

7. Conclusion

It is shown that the effectiveness of the balanced scorecard system as a management tool is initially determined by the quality of the formed strategy for the development of research objects. As applied to the forest complex and its subjects, such is the adaptive-offensive or co-evolutionary strategy of sustainable development. In the integrated model, adaptation to the parameters of sustainable development of the forestry complex was ensured through a radical transformation of the classic balanced scorecard system

format based on the identification of social, ecological and silvicultural and ecological projections. Within the framework of the stratum balanced scorecard system model, the description of an adaptive, co-evolutionary strategy was carried out by means of identifying the social, ecological and economic subprojects or strata in each projection of the classical balanced scorecard system model.

We believe that the format of balanced scorecard system with the allocation of social, forestry-ecological and economic projections is better suited for strategic management of the forest complex of the region and the country, and it is preferable to use the strategic model for the subjects of the forest complex (timber companies).

In our opinion, the addition and implementation of an integrated assessment in the balanced scorecard system will significantly strengthen the situation on modeling and forecasting the sustainable development of the forest complex in the digital economy (Bezrukova et al., 2019; Zinoveva et al., 2019).

The modification of the classical format of the balanced scorecard system by including integral partial assessments in its concept within the framework of projections and generalizing integral assessment as a measure of the level of sustainable development of an object significantly increased the effectiveness of this tool of strategic management in relation to various forest complex facilities.

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