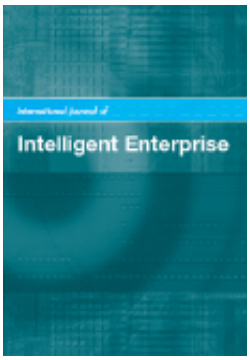

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A balanced scorecard system as a character of the enterprise's financial stability

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Abstract: The paper aimed to study a balanced scorecard (BSC) characterising the enterprise's stability from the perspective of compliance of its actual economic situation with future strategic goals. Based on indicative approach and using the provisions and approaches of the fuzzy sets theory, the integrated evaluation of level of achievement of BSC benchmarks of the enterprise was carried out. The scientific novelty of this study resides in the possibilities that the application of new tools (fuzzy sets theory, integrated evaluations) provides for monitoring both current and future performance indicators of an enterprise. The obtained results designate that proposed methodology can be applied in practice. The most significant its advantages incorporate the aggregation of criteria of varying nature, ability to calculate preliminary totals for different groups of indicators, possibility of making forecasts and managerial decisions based on results gained, and ability to assess expected economic condition of the enterprise through the BSC.

Keywords: strategy; financial stability; balanced scorecard; BSC; integrated evaluation.

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1 Introduction

Liberalisation and globalisation of economic processes and monumental changes in the geopolitical space have led to an increase in the uncertainty of the external and internal environment of individual economic entities' functioning. These circumstances have

greatly emphasised the need to determine scientifically based methods and approaches to effective enterprise management.

The system of effective enterprise control and management should be based on sustainable development principles, while the evaluation of sustainability should be performed using financial and economic approaches. Enterprise management should make allowance for a balance of interests of manufacturers and consumers to achieve the planned level of financial solvency of the enterprise and achieve economic sustainability in terms of compliance of the actual financial and economic situation with future strategic goals (Khudyakova, 2018). Evolution of the concept of sustainability associated with the requirements of society (the simultaneous presence of priority needs and constraints for their satisfaction) has dramatically transformed manufacturing systems' management models. The literature on the matter has proposed several indicator-based sustainability evaluation models representing the economic, environmental, and social dimensions of the triple bottom line concept. Some of them imply grouping the factors of an organisation's activities into internal and external. Others classify factors based on various types of sustainability, for example, production, financial, investment, marketing, innovation, environmental, social, and the like. However, all of these models have several drawbacks. In most cases, they assume a qualitative evaluation of sustainability indicators by converting qualitative indicators into quantitative ones using a system of scales. Besides, they investigate the stability of the enterprise directly only from the point of the principles of maintaining equilibrium. The definition of sustainability indicators has its difficulties as well. They relate to the presence of various sectors of the economy (agriculture, manufacturing, education, etc.), the size and capacity of the enterprise, the level of management ensuring a company's growth, and the state of internal and external environment of the organisation (Junior et al., 2018).

The uncertainty of the external environment of an economic entity and the subjectivity of decisions made determine the need to introduce a procedure for financial control of production processes that would make it possible to take optimal organisational and managerial actions aimed at increasing the financial and economic balance of production (Khudyakova, 2018). In order to solve the arising problems, responsible persons should analyse actual performance indicators and, on their basis, carry out measures and introduce effective methods to maintain the financial stability and stable development of the enterprise. In today's business environment, sustainability is a trend that can enable companies to incorporate social, economic, and environmental dimensions into the company management strategy. Although the concept of sustainability is not new, many organisations still have no idea of how to implement or measure its results (Kalender and Vayvay, 2016).

In recent years, the world academic community has paid increasing attention to the importance of strategic measurement systems including non-financial and financial indicators. Thus, many researchers have focused on a method called a balanced scorecard (BSC) (Acuña-Carvajal et al., 2019). The BSC offers enterprises a useful framework for controlling both their current performance (finances, customer satisfaction, business process results) and efforts directed at innovative development, employees' motivation and training, and information systems' quality improvement, i.e., the opportunity to develop in all directions (Kádárová et al., 2014). Therefore, depending on the production activity type, an enterprise should develop its own BSC to determine the sustainability and performance of its activities (Khabirov et al., 2018). The BSC is being developed to

complement the set of traditional indicators with new, more innovative ones. Undoubtedly, financial indicators are able to characterise the activities of an enterprise comprehensively. They are quite simple for calculations, and accounting and financial statements always have recent and reliable initial data for the analysis (Magasumovna et al., 2017). But still, it is very important to supplement the calculation of financial indicators with other non-financial ones for a more accurate idea of actual and long-term goals, as well as for profit forecasting and accumulation of funds (Khabirov et al., 2019). Such a system of indicators provides the possibility to assess the past, future, and present, and combine the enterprise's strategic objectives and financial prospects with reference to market conditions (Kaplan and Norton, 1992).

The BSC represents a qualitative basis for transforming the main goals of the enterprise into the system of performance and relevance indicators, distributed among four perspectives: financial, customer, business processes (internal), personnel learning and growth. Some indicators are used to measure the progress of an organisation in achieving its vision, whereas others are used to measure long-term factors of success (Kádárová et al., 2014). As such, BSC was developed by Robert Kaplan and David Norton in 1992 as an alternative to traditional approaches to measuring performance that focus purely on financial indicators and are based on past business results. Over the years, BSC has evolved from its early use as a simple performance measurement system to a full-fledged strategic planning and management framework (Lesáková and Dubcová, 2016). Today, BSC is used as one of the methods in controlling. It analyses the enterprise's activities from various perspectives and monitors the performance by financial criteria and by work with potential consumers, company employees, technological processes, information indicators, and intellectual experience (Kaplan and Norton, 2007). This system accumulates information and displays the general picture of processes directed at managing production and economic cycles and maintaining an enterprise's competitiveness at a high level (Khudyakova, 2018). The main task of a BSC is to increase the awareness of the company's management personnel about the degree of achievement of the planned financial independence and the level of economic stability, taking into account various risks.

This study endeavoured to calculate the BSC not only from the standpoint of maintaining stability of the enterprise but also from the perspective of growth and development. Its ultimate goal was to determine a BSC for assessing the economic sustainability of an enterprise. To assure its fulfilment, the following tasks were set and solved:

- Define a BSC characterising the performance of an enterprise.
- Conduct an integrated evaluation of the level of achievement of benchmarks in the BSC.
- Interpret benchmarks' achievement levels.

2 Materials and methods

Within the current research, the methodology for calculating the BSC was based on the example of JSC UAP Gidravlika. Gidravlika is a large Russian industrial enterprise engaged in the development and production of aircraft components and assemblies, as

well as space and defence technologies. It is located in the Republic of Bashkortostan and is a part of the Aviation Equipment holding of the Rostec State Corporation. The information base was the published balance sheet data and the statements of financial results and cash flows of JSC UAE Gidravlika for 2017–2019. Strategic goals and indicators of four BSC perspectives under measurement (financial, customer, business processes (internal), personnel learning and growth) are presented in Table 1.

The choice of this enterprise as a research object is explained by its long time of functioning and relatively large size, which makes it possible to study its statistical data for a lengthy time period, trace their dynamics, as well as use a significant set of numeric data to describe the qualitative characteristics of its activity.

The proposed indicators are imperative in the integrated evaluation of the level of achievement of BSC benchmarks. Their number may vary depending on the activity type and specialisation of the enterprise (Khasanov et al., 2019). Adequate integrated evaluation is possible using the methods developed within the indicative approach. It lies in the fact that for production data, calculated (dimensionless) variables (indicators) are used, by means of which one can characterise the degree of approximation of actual values to the target ones (Kantor and Kuznetsova, 2017).

The target values can be represented by normative or any values obtained by expertise. Integrated indicators are calculated according to the values of the calculated dimensionless variables (indicators), which further describe the enterprise as a whole. Integrated indicators visually interpret the results of a comparative analysis of the BSC by time periods (weeks, months, years). The key stages underlying the indicative approach embrace developing the structure of comparative indicators and markers, calculating the integrated indicator based on the values of these indicators and markers, and interpreting the collected results based on a scale of evaluation criteria (Kantor and Kuznetsova, 2017).

The current research also made use of the conceptual and instrumental apparatus of the fuzzy sets theory proposed in the middle of the 20th century by Lotfi Zadeh. He was the first to introduce the concept of a fuzzy set (collection of various elements) and the concept of a membership function (degree of membership in the set). According to Zadeh's theory, the elements of a set can be assigned any value in the range from 0 to 1. The value of 0 corresponds to absolute non-inclusion, while the value of 1 indicates full inclusion to this set (Dumitras and Moschytz, 2007). To set the membership function of a fuzzy set, one has to use expert evaluations or data from dynamic series of enterprise indicators. Hence, the fuzzy sets theory is widely applied to solve socio-economic problems when analysing BSC benchmarks' achievement.

However, the theory of fuzzy sets has several limitations one should be aware of while working with it. They relate to possible inconsistency of the quantitative indicators used to describe the qualitative characteristics of processes as well as large dimensionality of data space (the need to consider a significant number of indicators with different relationships between them). Besides, the proposed approach is more appropriate for enterprises operating in the market for a long time since it is far easier to implement when considerable statistical data on their activities are accumulated.

Table 1 BSC of the enterprise

Perspectives	*Strategic objectives*	*Indicators under measurement (performance indicators)*	*Actions to achieve goals*
1	*2*	*3*	*4*
Financial	Achieving optimal profitability level	Return on investment = net profit/capital employed Return on sales = profit before tax and interest on credit/revenue from sales and services	Increase or decrease in the sales price based on the marketing department research, implementation and development of a cost reduction program by finding new suppliers.
Customer	Expansion to potential goods and services markets	Market share = number of buyers over the period/number of buyers in the goods and services market over the same period.	Increased advertising costs (in particular for advertisements placed on the internet, in online magazines), increase in commissions to employees of the sales department for attracting new customers, improving after-sales service conditions and maintaining constant interaction with clients and contract owners.
	Attracting more buyers	Client attraction rate = (number of clients over the period – number of clients over the previous period)/ number of clients over the previous period.	
	Attracting new buyers in the largest share possible	Client retention rate = number of clients previously worked with the company/total number of clients.	
	Development on the existing goods and services markets	Client satisfaction rate = number of positive feedbacks/ total number of contracts.	
	Retention of most of regular customers	Net profit per contract = net profit per year/total number of contracts	
	Ensuring customer satisfaction		
	Ensuring optimal profit from buyers		
Internal business processes	Ensuring minimisation of defective products' manufacturing	Defect formation rate = number of defective products/number of manufactured products	Improving control over the production process, advancing the qualifications of personnel, total inspection of manufactured details.
	Ensuring efficient resource use	Productivity ratio = number of products manufactured/cost of materials used	
Personnel learning and growth	Ensuring employee contributions to the enterprise's productivity growth	Staff turnover rate = number of laid-off employees/average staff number Client satisfaction rate = number of positive feedbacks/ total number of contracts	Assessment and remuneration of employees, implementation of career development programs, professional training.

In general, the BSC presupposes the existence of a rule for a given criterion (x), according to which the indicator value (p) is assigned to a certain value of x. When

solving the integrated evaluation problem using the theory of fuzzy sets, for x, a set of values $x \in [x–, x+]$ was assigned.

The degree of membership of x was determined under the function:

$$\mu A : [x–, x+] \to [0, 1]$$

Given the available indicators of the enterprise and data on the range of indicators' variation, the following membership function was used:

$$t(x; a, b, c) = \begin{cases} 0, x \le a, \\ \dfrac{x-a}{b-a}, a \le x \le b, \\ \dfrac{c-x}{c-b}, b \le x \le c, \\ 0, x \ge c. \end{cases}$$

Thus, the integrated indicator was calculated according to the following sequence of stages (Kantor and Kuznetsova, 2017):

1 Analysis of the range of changes in the values of the actual indicator of the enterprise's BSC, when $x \in [x–, x+]$.

2 Construction of the membership function based on actual indicators.

3 Determination of the values of the membership function of the actual level of indicator x and equating it to its value p, i.e., $\mu A(x) = p$.

4 Calculation of the previous stages for each indicator of the enterprise's BSC. Composition of the indicator system;

5 Determination of the value of the integrated indicator of the level of achievement of BSC benchmarks:

$$I = p_1 * p_2 * \cdots * p_n$$

Calculation of the integrated indicator within the theory of fuzzy sets was performed using the arithmetic mean formula:

$$I = \frac{p_1 + p_2 + \cdots + p_n}{n}$$

6 Interpretation of the collected results (Table 2).

The proposed toolkit allows one to solve all the tasks set and interpret the obtained results in the most accurate way possible. This system enables the evaluation of the financial and economic stability of the enterprise system in dynamics (by days, weeks, months, quarters, years) and can be used for planning organisation and management of production. In a similar vein, it can be beneficial in carrying out the necessary analysis and evaluation of the expected financial and economic condition of the enterprise by using a BSC.

Table 2 Interpretation of the level of achievement of BSC benchmarks

Scale	*Achievement level*	*Interpretation*
[0, 0.2]	Very low	BSC benchmarks are almost unachievable
(0.2, 0.35]	Low	BSC benchmarks are rather unachievable than achievable
(0.35, 0.65]	Moderate	Zone of general uncertainty. BSC benchmarks can be equally achievable and unachievable
(0.65, 0.8]	High	BSC benchmarks are rather achievable than unachievable
(0.8, 1]	Very high	BSC benchmarks are quite achievable (the chances are pretty high)

3 Results

The integrated evaluation of BSC benchmarks' achievement level for the enterprise Gidravlika was performed by means of the fuzzy sets theory applied for 17 indicators for the time period from 2017 to 2019. The indicators under consideration were selected in during the preliminary analysis of the enterprise (Table 3).

Table 3 BSC of the JSC UAP Gidravlika

No.	*Indicators under measurement (performance indicators)*	*2017*	*2018*	*2019*
1	Return on investment, %	1.1	1.3	1.22
2	Return on sales, %	9.74	10.3	10.23
3	Costs per ruble revenue, thousand rubles	0.88	0.88	0.88
4	Work output per man, thousand rubles/person	7.67	7.67	7.99
5	Workforce productivity, thousand rubles/person	753.9	753.9	812.5
6	Fixed assets turnover ratio, rubles	1.02	1.02	1.13
7	Current asset turnover ratio	1.73	1.73	1.88
8	Financial stability ratio	0.68	0.68	0.65
9	Liquidity ratio	1.1	1.1	1.2
10	Market share, %	2.9	2.9	2.7
11	Client attraction rate, %	0.2	0.2	1.22
12	Client retention rate, %	99	99	98
13	Client satisfaction rate	0.89	0.89	0.95
14	Net profit per contract, thousand rubles	121.67	121.67	145.12
15	Defect formation rate, %	0.83	0.83	0.82
16	Productivity ratio	0.75	0.75	0.71
17	Staff turnover rate, %	12.1	12.1	8.5

The membership functions of the selected criteria were determined by the method of expertise. These functions define the degree of achievement of the BSC's strategic guidelines, or, in other words, define the level of indicators that the enterprise seeks to achieve while implementing measures to improve its financial solvency and economic stability.

An in-depth examination of production indicators allowed outlining that some of them are likely to grow (return on investment, financial stability), while others decrease (costs per ruble of revenue, employee turnover rate, etc.). Accordingly, the methods of determining their grade of membership differed (Table 4).

Table 4 Methods for constructing membership functions of some integrated evaluation criteria

Return on sales, %	x	1	3	6	9	12	15	20
	$\mu A(x)$	0	0.15	0.30	0.45	0.60	0.75	1
Costs per ruble revenue, rubles	x	1	0.9	0.7	0.5	0.3	0.2	0
	$\mu A(x)$	0	0.1	0.3	0.5	0.7	0.8	1

Table 5 shows the variation of the analysed indicators, of their membership functions, and, accordingly, of the level of achievement of the BSC benchmarks.

Table 5 Calculation of the integrated indicators of the enter

No.	*Indicators under measurement (performance indicators)*	*Range of variation*	*μA(x)*		
		[x–, x +]	*2017*	*2018*	*2019*
1	Return on investment, %	[0.1, 20]	0.030	0.055	0.045
2	Return on sales, %	[0.1, 20]	0.404	0.487	0.412
3	Costs per ruble revenue, thousand rubles	[0, 0.99]	0.045	0.044	0.044
4	Work output per man, thousand rubles/person	[0.1, 10]	0.411	0.511	0.634
5	Workforce productivity, thousand rubles/person	[0.1, 900]	0.687	0.838	0.956
6	Fixed assets turnover ratio, rubles	[0.1, 5]	0.172	0.204	0.389
7	Current asset turnover ratio	[0.1, 5]	0.374	0.346	0.383
8	Financial stability ratio	[0.6, 0.9]	0.733	0.756	0.725
9	Liquidity ratio	[1.1, 2.5]	0.440	0.440	0.52
10	Market share, %	[0.1, 5]	0.620	0.580	0.45
11	Client attraction rate, %	[0.2, 5]	0.202	0.040	0.344
12	Client retention rate, %	[92, 100]	0.980	0.990	0.96
13	Client satisfaction rate	[0.5, 1]	0.010	0.009	0.01
14	Net profit per contract, thousand rubles	[100, 300]	0.210	0.162	0.215
15	Defect formation rate, %	[0, 2]	0.405	0.415	0.395
16	Productivity ratio	[0, 5]	0.162	0.166	0.171
17	Staff turnover rate, %	[5, 15]	0.822	0.978	0.689
	Integrated indicator		0.394	0.413	0.448

The observed level of achievement of BSC benchmarks can be regarded as moderate since the reviewed indicators appeared to be settled in the zone of general uncertainty. Consequently, BSC benchmarks can be defined as both achievable and unachievable depending on further management and development strategies. To a great extent, enterprise leadership may perceive such an outcome as a kind of guideline for making managerial decisions directed at increasing or decreasing the measured key performance indicators.

4 Discussion

The proposed methodology deserves to be applied in view of its obvious advantages. First of all, it provides an opportunity to aggregate criteria of varying nature. Aggregation allows the personnel to adequately compare financial indicators of an enterprise's operation for different time periods without fear of choosing optimal solutions with no account taken of the threshold criteria and other factors. The approach used within the present investigation combines the integrated indicator with the main criteria of the BSC (individual factors of the company's performance). It enables making relevant organisational and managerial decisions due to the availability of a comprehensive set of single-dimension indicators reviewed from the perspective of their development dynamics. Another important point is that the applied methodology enables calculations of preliminary totals for different groups of indicators. Identification of similar groups of target indicators affords the ground for navigating in the balanced indicators, thereby proposing the vector of necessary actions to personnel. On top of this, the approach used facilitates understanding of possible criteria tendencies and their segmentation by significance and value in the integrated weight, excludes data distortion, and allows making fuzzy concepts clearer.

As concerns four determinants of BSC (service satisfaction, process capability, knowledge assets, and service cost), this method provides qualitative and quantitative indicators, four evaluative dimensions, and a three-layer network evaluation system index. Many authors also indicate that the proposed approach contributes to the ability of decision-makers to understand the complex relationship between factors in the selection process (Hu et al., 2019). In general, the applied model can be useful for defining performance indicators for sustainability assessment and can be integrated into multi-criteria decision methods to raise organisational sustainability and performance (Junior et al., 2018).

A number of researchers point out that the BSC has transformed from a usual performance measurement system to a strategic management system. It has become very popular among practitioners due to its consideration of strategic goals and performance indicators corresponding to the organisation's mission and strategy. However, since the BSC was initially developed as a system directed at measuring performance, the use of financial metrics to evaluate a company's performance from a strategic perspective by looking at indicators from other viewpoints remains somewhat challenging (Quezada et al., 2019).

Sánchez-Márquez et al. (2018) argue that the BSC provides managers and executives with a tool to discover if processes are improving or worsening. This method addresses the formerly unresolved problem of data uncertainty due to the size of the sample for key performance indicators on scorecards (Sánchez-Márquez et al., 2018). In a similar vein, Lesáková and Dubcová (2016) state that BSC can be referred to as a system for strategic planning and management used to organise business based on specific vision and strategy. It can be beneficial in building effective internal and external communication and monitoring and improving the enterprise's performance against the backdrop of its ultimate goals. Therefore, it can be confidently viewed as a management system built upon the logic of the management circle (plan-do-check-act) (Kaplan and Norton, 2007). As shown by a comprehensive literature review, BSC is likely to be seen as the most suitable research model for measuring performance and converting an organisation's strategic objectives into a set of performance indicators.

As a direction for further investigation, relationships between current strategies and sustainability aspects can be chosen. In order to perform their in-depth examination, once the right measurement system is defined for the company, one should concentrate on creating an integration process via using management approaches. This integration process can be supported by the provided benefits of a sustainable BSC. The demonstration of what benefits can be achieved with sustainable BSC can be done by applying a game-theoretical approach. It can assist in implementing strategies selected for each dimension to see which of them provide the most eminent advantages in terms of profit (Kalender and Vayvay, 2016).

5 Conclusions and recommendations

The conducted examination revealed that the integrated indicator of the level of achievement of BSC benchmarks makes it possible to trace the dynamics of economic and production activities of an enterprise and compare its performance indicators by time intervals (months, decades, years). At the same time, it remains useful when it comes to the analysis of possible outcomes and fruitfulness of the implementation of global manufacturing planning and actions directed toward performance improvement and risk reduction.

The developed model for the integrated evaluation of the BSC benchmarks' achievement level can be found useful by enterprises' management in the field of substantiating organisational and managerial decisions in two directions:

- As a tool for strategic planning and control of BSC benchmarks' achievement – this will allow monitoring the realisation of planned economic development (rational, profitable, optimal, etc.) and sustainable growth scenarios (the main purpose of the indicator).
- As a tool for selective assessment of the level of BSC benchmarks' achievement by the most critical factors characteristic of a specific enterprise, taking into account the market of operation, specialisation, type of products, adopted technologies, personnel qualifications, and risks (additional purpose of the indicator).

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