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The sustainable enterprise development tetrad and assessment of its balance

Abstract. The concept of sustainable development is traditionally associated with the economy, society, ecology, and building relationships between them. At the enterprise level, this means that economic, social and environmental goals are at least consistent with each other. The validity of this understanding is beyond doubt. However, in modern conditions it is practically impossible to ensure the long-term and competitive functioning of enterprises without the use of information technologies in their activities. This article provides arguments regarding the need to transform information stability from factors into a determinant of sustainable development, thereby turning the traditional triad into a tetrad. On the other hand, due to this expansion, it becomes more relevant to assess the balance of the sustainable development components. In this regard, the purpose of the study is to develop and apply a methodology for assessing the balance of the economic, social, environmental, and information components of sustainable development according to the criteria of reliability, dynamism, and acceptability. Research results of small and medium-sized enterprises in Russia indicate that only two out of fifteen enterprises achieved a high level of balanced sustainable development. In most cases, regardless the sustainable development level, the balance of determinants is at a lower level. Moreover, cases with a high but not balanced sustainable development confirmed the assumption that a high sustainability level for some determinants can compensate for a low sustainability level for others. The results obtained prove that the real vector of sustainable development can be determined only in accordance with the balance degree.
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Тетрада сталого розвитку підприємства та оцінка її збалансованості
Анотація. Концепція сталого розвитку традиційно асоціюється з економікою, соціумом, екологією і побудовою взаємин між ними. На рівні підприємств це означає, що економічні, соціальні та екологічні цілі як мінімум не повинні суперечити один одному. Правомірність такого розуміння сутності сталого розвитку не викликає сумнівів. Однак у сучасних умовах практично неможливо забезпечити довгострокове й при цьому конкурентоспроможне функціонування підприємств без застосування ними у своїй діяльності інформаційних технологій. У статті наводяться аргументи щодо необхідності трансформації інформаційної стійкості з факторів у детермінанти сталого розвитку, тим самим перетворивши традиційну тріаду в тетраду. З іншого боку, таке розширення ще більше актуалізує

питання про збалансованість його складових компонентів. У зв'язку з цим мета статті полягає в розробці та застосуванні методології оцінки збалансованості економічної, соціальної, екологічної, інформаційної детермінант сталого розвитку відповідно до критеріїв надійності, динамічності, прийнятності. Результати дослідження малих і середніх підприємств Росії свідчать, що тільки в двох підприємств із п'ятнадцяти сталий розвиток і збалансованість детермінант знаходилися на високому рівні. У більшості випадків, незалежно від досягнутого ними рівня сталого розвитку, збалансованість його детермінант знаходилася на більш низькому рівні. Понад те, випадки з низькою або критичної збалансованістю при високому рівні сталого розвитку підтвердили припущення про можливість компенсації низької стійкості щодо одних детермінант високою стійкістю щодо інших із них. Це доводить, що реальний вектор розвитку підприємства може бути визначений тільки з поправкою на рівень збалансованості.

Ключові слова: сталий розвиток; компоненти; тетрада; збалансованість; оцінка.

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Тетрада устойчивого развития предприятия и оценка ее сбалансированности

Аннотация. Концепция устойчивого развития традиционно ассоциируется с экономикой, социумом, экологией и построением взаимоотношений между ними. На уровне предприятий это означает, что экономические, социальные и экологические цели как минимум не должны противоречить друг другу. Правомерность такого понимания сущности устойчивого развития не вызывает сомнений. Однако в современных условиях практически невозможно обеспечить долгосрочное и при этом конкурентоспособное функционирование предприятий без применения ими в своей деятельности информационных технологий. В статье приводятся аргументы относительно необходимости трансформации информационной устойчивости из факторов в детерминанту устойчивого развития, тем самым превратив традиционную триаду в тетраду. С другой стороны, такое расширение еще больше актуализирует вопрос о сбалансированности составляющих компонентов. В этой связи цель статьи заключается в разработке и применении методологии оценки сбалансированности экономической, социальной, экологической, информационной детерминант устойчивого развития в соответствии с критериями надежности, динамичности, приемлемости. Результаты исследования малых и средних предприятий России свидетельствуют, что только у двух предприятий из пятнадцати устойчивое развитие и сбалансированность детерминант находились на высоком уровне. в большинстве случаев, независимо от достигнутого ими уровня устойчивого развития сбалансированность его детерминант находится на более низком уровне. Более того, случаи с низкой или критической сбалансированностью при высоком уровне устойчивого развития подтвердили предположение о возможности компенсации низкой устойчивости по одним детерминантам высокой устойчивостью по другим. Это доказывает, что реальный вектор развития предприятия может быть определен только с поправкой на уровень сбалансированности.

Ключевые слова: устойчивое развитие; компоненты; тетрада; сбалансированность; оценка.

1. Introduction

Despite the seemingly simple interpretation, sustainable development is a complex category that characterizes enterprises. Their «vitality» depends on the ability to maintain their position in the area of sustainability in all key spheres, that is, in fact, components of sustainable development.

At the present stage, the success and long-term viability of enterprises also depends on the use of various information technologies. In this aspect, we mean not so much the automation of production processes as the use of broadband Internet, cloud services, RFID technologies, ERP systems, and inclusion in e-commerce. Note also remote work, which is not only a trend of the time but also quite possibly will become an integral part of our life. This method of work organization had already been actively discussed for several years before the pandemic began. The first results, which can be viewed as reflection of the real attitude towards teleworking, indicate positive feedback from an economic point of view (Gurova, 2020). The organizational aspect remains a problematic issue, including ensuring information security.

In this context, is it enough in modern conditions to characterize an enterprise from the standpoint of sustainable development and analyze the results of activities in the economic, social, and environmental spheres without including the information component in the traditional triad?

In addition, there is a question about the adequacy to assess at the enterprise level the degree of sustainable development alone. Is this informative enough even if the assessment is segmented into an expanded number of components? In other words, there should be such a relationship

between the performance of enterprises in the economic, social, environmental, and information areas as to ensure that high performance in some areas does not compensate for poor performance in others. On the other hand, a high level of balance can be observed against the background of low indicators of the constituent components, which also does not correspond to the target settings.

2. Brief Literature Review

Sustainable development and issues directly or indirectly related to it have been on the agenda for several decades (Vertakova & Plotnikov, 2017). Considering its traditional components, this has led to the emergence of a number of main sections on this topic (Kolk, 2016). However, one of the key challenges is the unilateral emphasis on the components of sustainable development.

As a rule, attention is focused on the environmental component. This can manifest itself in different ways and in different interpretations: proactive entrepreneurship and linkages with environmental quality (He et al., 2020), environmental policy flexibility and its impact on technological innovation related to sustainable development (Yuan & Zhang, 2020), and «green» innovations and their role in ensuring competitive advantages (Zhou et al., 2020). If the emphasis is on social sustainability, the complexity of its content is noted, while social sustainability itself is presented through the results of relationships with employees, customers, etc. (Lee et al., 2021).

Such explicit emphasis on considering only some of the components of sustainable development may be motivated by the interests of the enterprises themselves. It is indisputable that in the modern world adherence to the principles of sustainable development actually allows them to achieve competitive advantages through open demonstration and positioning themselves as socially responsible entities (Chang & Cheng, 2019; Matinaro et al., 2019). In addition, image, branding, and reputation have become serious nonfinancial incentives for the implementation of sustainable development practices. Special emphasis is placed on institutional and legislative requirements; thus, the focus may shift from profitability to maintaining a law-abiding reputation (Dey et al., 2018; Zhang & Cui, 2020). This is especially true at the level of small and medium-sized enterprises (Aroshidze, 2020), whose degree of adherence to environmental and social imperatives is often determined only by the need to comply with legal regulations (Trianni et al., 2019). However, in recent years, enterprises themselves have become more and more open to building various sustainable interactions (Xu et al., 2020), and issues are being worked out on the full implementation of the principles of sustainable development in their activities, although again especially in terms of ensuring social sustainability (Prashar, 2019; Prashar & Sunder, 2020; Veronica et al., 2020).

Focusing on the social and environmental components can also be caused by the existing difficulties in these areas when implementing the principles of sustainable development and attempting to find possible solutions to these problems in practice. For example, we can talk about ways of building relationships with business partners, institutions, and public organizations (Chen et al., 2017; Liu et al., 2020; Stekelorum et al., 2020) and an algorithm for introducing the principles of corporate social responsibility (Klapper & Farber, 2016). In the same context, questions about the role of special training programs for management are sufficiently worked out, revealing the principles of management in accordance with the goals of sustainable development (Ndubuka & Rey-Marmonier, 2019) and forming the necessary competencies (Stål & Babri, 2020; Wong & Ngai, 2021).

Note that scientific research still attempts to comprehensively consider the components of sustainable development and even prioritize them but again only within the traditional triad (Chang et al., 2018). It is noted that enterprises should rank the stated goals and objectives; form their specific system, focused on their field of activity, opportunities, and strategy (Bajdor & Pawełoszek, 2020; Ike et al., 2019); and consider a number of other factors (Hong et al., 2019; Sokil et al., 2020).

In this regard, the question arises not only of assessing sustainable development, even with its full-fledged segmentation by components, but also of assessing the balance of results by them. However, scientific research typically uses «balance» in only a few key contexts.

First, to assess enterprise activities at the stage of forming the system of indicators (scorecard). A balanced scorecard is used, in particular, to measure productivity (Quezada, 2019), as well as the efficiency of production and business processes (Sanchez-Marquez, 2018); to estimate the success of the strategy implementation processes and the need to revise the strategy's individual parts; and to develop new strategies (da Costa Ferreira, 2017). Quite often and, of course, quite

justifiably, balanced scorecard methods are used when choosing performance indicators that characterize enterprises in terms of sustainable development (e.g., Nicoletti Junior, 2018). In addition, the balanced scorecard integrates with various models for assessing sustainability, in particular its key factors (Lu et al., 2018); building cause-and-effect relations; and adhering to the principles of inclusiveness (Guix & Font, 2020).

Second, balance is used in the context of a systemic organization in an enterprise. Kleiner & Rybachuk (2019) interpret it as the proportionality of the sizes of the four system sectors with an approximate equality of the intensity of exchange between adjacent sectors (object, environmental, project, and process).

Third, balance is traditionally used as a characteristic of budgets at various levels. First of all, of course, we mean the budgetary balance of the country, regions, and municipalities (Slavík et al., 2019; Nath & Sandholm, 2019; Makrelov et al., 2020). At the enterprise level, such consideration is carried out through the features of the balance sheet (Çolak, 2020; Hsu et al., 2021).

3. Results

3.1. Methodology for assessing the balance of the sustainable development tetrad components

In the author's interpretation, the balance reflects the similarity between indicators in terms of components and criteria of sustainable development, which determines its assessment procedure sequence (Figure 1).

The stability indicators of components the balance between which is assessed is calculated according to the criteria of reliability, dynamism, and acceptability. There are 12 indicators, which form among themselves 66 pairs. The distance between values in a pair (A), calculated as the difference in absolute value, is actually a measure of the similarity of indicators (Table 1).

A qualitative description of the remoteness of indicators in each pair should be based, first of all, on the establishment of a quantitative limit, the excess of which is evidence of insignificant similarity between the indicators. Establishing 0.25 units as the value of the maximum distance allows to characterize the indicators of determinants that are at the same or adjacent level of stability. Consequently, the distance in a pair of indicators within [0; 0.25] means that it belongs to the class of the greatest similarity that meets the balance requirements.

Since two or more pairs can be characterized by the same internal distance between the indicators but at the same time differ significantly from each other in terms of level belonging, it is necessary to distinguish groups within the class. Possible groups are determined by the number of stability levels and the range of variation of the initial and final coordinates of the class (Table 2).
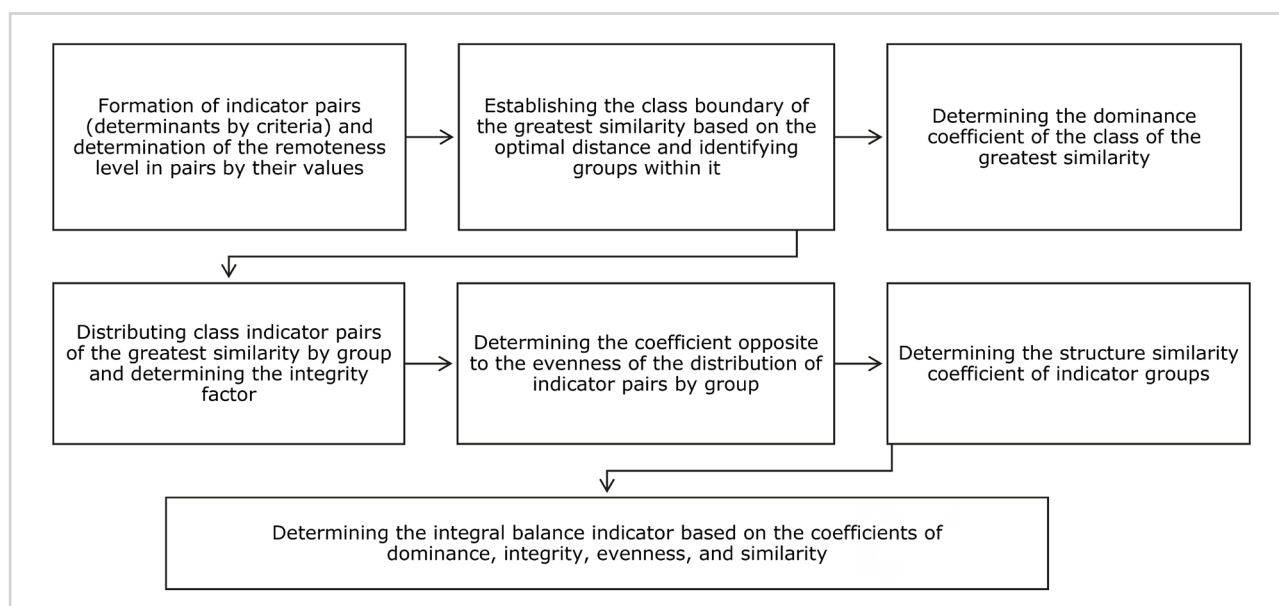

Figure 1:
Stages of computing and information-analytical procedures for balance assessment
Source: Author's own research

To calculate the dominance coefficient (PRf), due to the simplicity and full ability to convey the meaning necessary for the current task, the algorithm for calculating the specific weight is used: the number of pairs of indicators in the class of greatest similarity is correlated with the total number of pairs. When calculating the integrity factor of the class structure (INf), it is necessary to take into account that the presented groups are potentially possible and the probability of their selection in their entirety tends to zero. In this regard, the number of indicator pairs that were attributed to the class of the greatest similarity is proposed to be considered as an integral structure, which is divided in accordance with the inherent classification features into a particular number of groups.

Also, to calculate the integral indicator of balance, it is necessary to assess how similar pairs of indicators are distributed among groups. By analogy with the Shannon-Weaver indices and Pielou's evenness used in the analysis of ecosystems, the calculation of the coefficient is aimed at identifying the proportionality of the distribution of pairs in the selected groups within the class of greatest similarity. The coefficient takes values from 0, which corresponds to a complete disproportion (lack of evenness) in the distribution of indicator pairs by groups, to 1, which corresponds to the absolute proportionality of the distribution:

$$EV = \frac{\sum_{i=1}^{G} \frac{q_i}{q} \times \left|\log_{10} \frac{q_i}{q}\right|}{\log_{10} G},$$ (1)

where:
q_i is the number of indicator pairs in a group;
q is the total number of indicator pairs;
G is the number of groups formed.

Table 1:
Similarity measure matrix of sustainable development determinant indicators

	E_R	E_D	E_A	S_R	S_D	S_A	EL_R	EL_D	EL_A	I_R	I_D	I_A
E_R		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11
E_D	A1		A12	A13	A14	A15	A16	A17	A18	A19	A20	A21
E_A	A2	A12		A22	A23	A24	A25	A26	A27	A28	A29	A30
S_R	A3	A13	A22		A31	A32	A33	A34	A35	A36	A37	A38
S_D	A4	A14	A23	A31		A39	A40	A41	A42	A43	A44	A45
S_A	A5	A15	A24	A32	A39		A46	A47	A48	A49	A50	A51
EL_R	A6	A16	A25	A33	A40	A46		A52	A53	A54	A55	A56
EL_D	A7	A17	A26	A34	A41	A47	A52		A57	A58	A59	A60
EL_A	A8	A18	A27	A35	A42	A48	A53	A57		A61	A62	A63
I_R	A9	A19	A28	A36	A43	A49	A54	A58	A61		A64	A65
I_D	A10	A20	A29	A37	A44	A50	A55	A59	A62	A64		A66
I_A	A11	A21	A30	A38	A45	A51	A56	A60	A63	A65	A66	

Determinants: E, economic; S, social; EL, environmental; I, informational.
Criteria: R, reliability; D, dynamism; A, acceptability

Source: Authors' own research

Table 2:
Classification characteristics for grouping indicator pairs

Sustainability levels	Distance between indicators in a pair		
high–high medium–medium low–low critical–critical	0	from 0 to 0.12	from 0.12 (inclusive) to 0.25 (inclusive)
high–medium medium–low low–critical	from 0 to 0.12		from 0.12 (inclusive) to 0.25 (inclusive)

Source: Authors' own research

It is obvious that after grouping, in one or several groups there may be a number of pairs that is several times higher than their number in others, which indicates disproportions in the scale of similarity of indicator pairs with a given internal distance. The evenness coefficient reflects the presence of the above-mentioned disproportions and the degree of their manifestation, which depends on the number of indicator pairs and selected groups. In the context of final balance, the duality of their understanding can be traced. On the one hand, for example, when distinguishing two groups, the ratio can be ten to one, that is, ten indicator pairs are similar to each other, while the remaining pair cannot be attributed to this group and does not have a similar pair in principle. In other words, the greater the number of indicator pairs that form a certain group, the greater is the number of similar pairs that each of them has, which means that we can speak about a greater balance in the classification features that characterize them in comparison with others. On the other hand, disproportions in distribution can have a positive effect on the overall balance of determinants across criteria. Indeed, even if more than one group is selected, the most favorable is the situation when most indicator pairs will be in one of them (or at least in the minimum possible number of them). To some extent, the solution of this contradiction is facilitated by the calculation of the coefficient of similarity of the structures of the selected groups.

Thus, the indicator of the determinant by the criterion, pairing with another indicator and by the degree of similarity being in the considered class in a certain group, can form a pair with other indicators. The degree of similarity with them will determine its location in another group. Consequently, it is necessary to compare the groups with each other not only by the quantitative saturation by pairs, which is what the evenness coefficient is aimed at, but also by the number of identical indicators. The calculation takes into account the real number of identical indicators and does not consider the frequency of their occurrence within the same group. Since all groups are in the class of greatest similarity with each other, the similarity coefficient is also a reflection of balance since the same indicators can form different pairs belonging to the target class. The role of this coefficient in this aspect increases as the number of groups in the class increases. Calculation of the coefficient of similarity with the range of values [0; 1] is based on the principle of calculating the Jaccard coefficient:

$$LK = \frac{\sum_{i=1}^{tg} LK_f}{\sum_{i=1}^{tg} LK_{max}} = \frac{\sum_{i=1}^{tg} \frac{q_{ia}}{q_{i1} + q_{i2} - q_{ia}}}{\sum_{i=1}^{tg} LK_{max}},$$ (2)

where:
LK_f is the actual coefficient of similarity of a pair of groups;
LK_{max} is the maximum possible coefficient of similarity of a pair of groups;
q_{ia} is the number of identical indicators in the considered pair of groups;
q_{i1} is the number of indicators in the first group of the pair under consideration;
q_{i2} is the number of indicators in the second group of the pair under consideration;
tg is the total number of group pairs.

The most suitable way to calculate the integral balance coefficient (BL) is the summation of all partial coefficients and subsequent normalization relative to their total number. The choice in favor of the summation of indicators is due to the need to avoid a zero integral indicator in the case of a zero value of at least one partial coefficient (except for the dominance coefficient) in connection with the range for them from 0 to 1:

$$BL = \frac{PR_f + IN_f + EV_f + LK_f}{4}.$$ (3)

In addition, when calculating the integral indicator, assumptions are made that are necessary for a more correct interpretation of the results. First, if, as a result of grouping, the number of groups formed is equal to the total number of indicator pairs assigned to the class of the greatest similarity, the coefficients of evenness and similarity are taken equal to 0. Second, if all pairs of indicators are in the class of the greatest similarity and within one group, the coefficients of evenness and similarity are taken equal to 1.

A qualitative interpretation of the integral balance coefficient is presented as follows: from 0 to 0.25 is the critical level, from 0.25 (inclusive) to 0.5 is the low level, from 0.5 (inclusive) to 0.75 is the medium level, and from 0.75 (inclusive) to 1 (inclusive) is the high level.

3.2. The results of assessing the sustainable enterprise development and the balance of its determinants

The developed methodology was tested for 15 small and medium-sized enterprises of light industry in the Siberian Federal District (Russia). These SMEs (Table 3) are in the list of the light industry's largest enterprises by revenue (Top-50). According to the main performance indicators, these enterprises occupy a stable position, which is confirmed by their positive dynamics in most cases. However, sustainable development is not identified only with the economic component. Due to the high indicators of the economic sphere, the final coefficient of sustainable development can also reach a high level, but with a low balance degree among economic, social, environmental and information components.

So, as we can see, a high level of sustainable development and a high level of balance of determinants were characteristic of only two enterprises (Table 4). Only two out of the fifteen enterprises were able to achieve a high level of sustainable development with a medium level of balance of economic, social, environmental, and information sustainability according to the criteria of reliability, dynamism, and acceptability. The same number of enterprises was characterized by the ratio of a high level of sustainable development and a low degree of balance of its determinants. In addition, there was a situation where sustainable development and balance were at opposite levels of the range, namely high-critical. In general, a high level of sustainable development was observed in 46.7% of enterprises.

Six enterprises (40%), according to their performance results, can be attributed to the medium level of sustainable development. At the same time, the balance between the determinants by criterion for one enterprise was characterized by a high level, and for two enterprises the level of sustainable development and balance coincided. Half of enterprises with a medium level of sustainable development were able to achieve it against the background of only a low

Table 3:
Key performance results of enterprises, 2020, thousand dollars at the rate of 73.88 rubles per dollar (31.12.2020)

Enterprise	Revenue	Net profit	Main activity
LLC «Indikont»	2585.27	1.02	manufacture of workwear
LLC «Caps and Hats»	2422.85	87.71	manufacture of clothing and accessories
LLC «Sibiryak»	2409.31	54.01	manufacture of clothing and accessories
LLC «Omega 54»	2138.60	23.28	manufacture of knitted and crocheted fabrics
LLC «Siberian textile manufactory»	1732.54	51.43	manufacture of knitted and crocheted fabrics
LLC «Jetty»	1273.69	135.22	manufacture of outerwear
LLC «Partner»	1130.21	487.28	manufacture of clothing and accessories
LLC «Luxury Plus»	1070.66	64.16	manufacture of outerwear
LLC «Chance»	961.02	59.69	manufacture of outerwear
LLC «Eva Mancini»	868.98	220.63	manufacture of outerwear
LLC «Cinelle»	717.38	40.74	manufacture of clothing and accessories
LLC «Prima Line»	714.67	22.33	manufacture of outerwear
LLC «Limonti»	591.50	165.13	manufacture of outerwear
LLC «Lyudmila»	406.06	123.44	manufacture of outerwear
LLC «Sewing Technologies»	299.13	4.05	manufacture of clothing and accessories

Source: SPARK https://www.spark-interfax.ru

Table 4:
Comparing the levels of sustainable development and the balance of its determinants

Enterprise	Sustainable development		Balance of determinants	
	indicator	level	indicator	level
LLC «Limonti»	0.84	high	0.29	low
LLC «Prima Line»	0.52	medium	0.44	low
LLC «Sewing Technologies»	0.48	low	0.42	low
LLC «Chance»	0.71	medium	0.51	medium
LLC «Luxury Plus»	0.77	high	0.50	medium
LLC «Cinelle»	0.62	medium	0.71	medium
LLC «Jetty»	0.81	high	0.24	critical
LLC «Omega 54»	0.57	medium	0.34	low
LLC «Eva Mancini»	0.91	high	0.93	high
LLC «Lyudmila»	0.79	high	0.39	low
LLC «Siberian textile manufactory»	0.53	medium	0.98	high
LLC «Sibiryak»	0.66	medium	0.45	low
LLC «Indikont»	0.41	low	0.59	medium
LLC «Caps and Hats»	0.79	high	0.55	medium
LLC «Partner»	0.94	High	0.81	High

Source: Author's own research

degree of balance of economic, social, environmental, and information sustainability in terms of criteria.

A low level of sustainable development was observed only in two enterprises (13.3%) of the total number of the surveyed ones, while the degree of balance of determinants was at a low and medium level.

In quantitative terms, the largest gap between the indicators of sustainable development and balance was 0.57 (high-critical level). The smallest gap in absolute value was 0.02 units; being at a high level, the indicator of sustainable development was slightly less than the indicator of the balance of its determinants. The average value of the balance indicator for enterprises with a low level of sustainable development was the smallest of all (0.51). The minimum value of balance for the same enterprises was 0.42, which is more than the same indicator for other enterprises (Figure 2). The highest average value of balance was observed in enterprises with a medium level of sustainable development (0.57). As expected, the same enterprises were characterized by the highest maximum of the balance indicator among all. Interestingly, for enterprises with a high level of sustainable development, the minimum value (0.24) was also the minimum among all studied enterprises, regardless of the achieved level of sustainability.
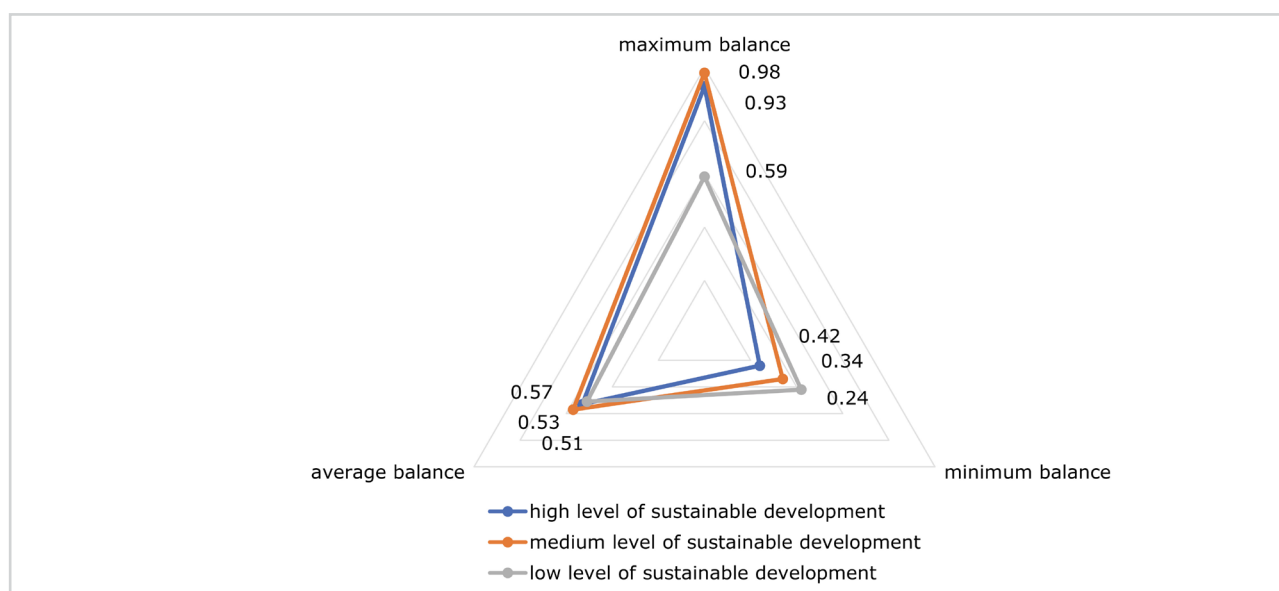

Figure 2:
**Characteristic indicators of the balance of determinants
for different levels of sustainable development**
Source: Author's own research

In the group of enterprises with a high level of sustainable development, in the overwhelming majority of cases, the degree of balance did not fall below the average. This means that the economic, social, environmental, and informational sustainability by the criteria of reliability, dynamism, and acceptability quite comparable to each other and in the aggregate ensure a high level of sustainable enterprise development. However, cases with a low and especially critical level of balance confirmed the assumption that a high sustainability level for some determinants can compensate for a low sustainability level for others. Consequently, despite the high quantitative indicators, it is incorrect to fully attribute these enterprises to the group of sustainably developing ones.

For enterprises with a medium level of sustainable development, the prevailing low degree of balance can also be considered as a clear sign of the effect of the compensation mechanism. However, in this case, further detailing is required to identify those determinants and criteria that form its basis. Obviously, there is a high probability that some of them may refer to a high level, while others, to a low or even critical level. In this group, the medium degree of balance was widespread; that is, the indicators of the stability of the determinants by the criteria can be quite adequately compared with each other. A high level of balance, indicating that almost all determinants were in the medium zone of sustainability according to the criteria, was rather an exception in this group.

For a low level of sustainable development, a high degree of balance, as a rule, is viewed from a negative standpoint since in this case all determinants by the criteria are at a comparably low level. On the other hand, low balance may indicate that some of the determinants are at a much higher level.

Despite the fact that quite often it was at a high level of sustainable development that a strong imbalance of determinants was observed, the correlation analysis did not reveal a relationship between indicators of sustainable development and balance. In other words, an increase in the indicator of sustainable development of the studied enterprises was not reflected either in an increase or in a decrease in the degree of balance of economic, social, environmental, and information sustainability by the criteria.

However, the results obtained allow us to conclude that enterprises, setting themselves the goal of achieving sustainable development, adhere to a focus on certain components, thereby segmenting their management tasks. For the studied enterprises, the priority area is precisely the economy (in contrast to foreign trends), although there is also an increasing orientation towards social sustainability. To a lesser extent, priorities are placed between the environmental and information components. In addition, enterprises often focus only on achieving indicators in the areas of sustainable development that allow them to operate safely, overshadowing their dynamics, its focus, stability, and fluctuations in growth rates. In the long term, these management gaps can lead to the loss of the most optimal vector of sustainable development.

3.3. Diagnostics of sustainable development and balance of its determinants
The diagnostic map of sustainable development (Figure 3) made it possible to group enterprises according to level and direction of changes over a period (one year), as well as to reveal the characteristic degree of balance.

To build a diagnostic map, indicators of sustainable development of each enterprise were plotted on the abscissa axis, and the delta of the indicator compared to the previous year was plotted on the ordinate axis. Taking into account the average value of the indicator of sustainable development of the studied enterprises, four groups were identified. The first group includes the leading enterprises, that is, with an indicator of sustainable development above the average and an increase in comparison with the previous year. The second group is formed by catching-up enterprises, that is, with a sustainable development indicator below the average but with an increase in it. The third group is represented by enterprises that are losing their potential for sustainable
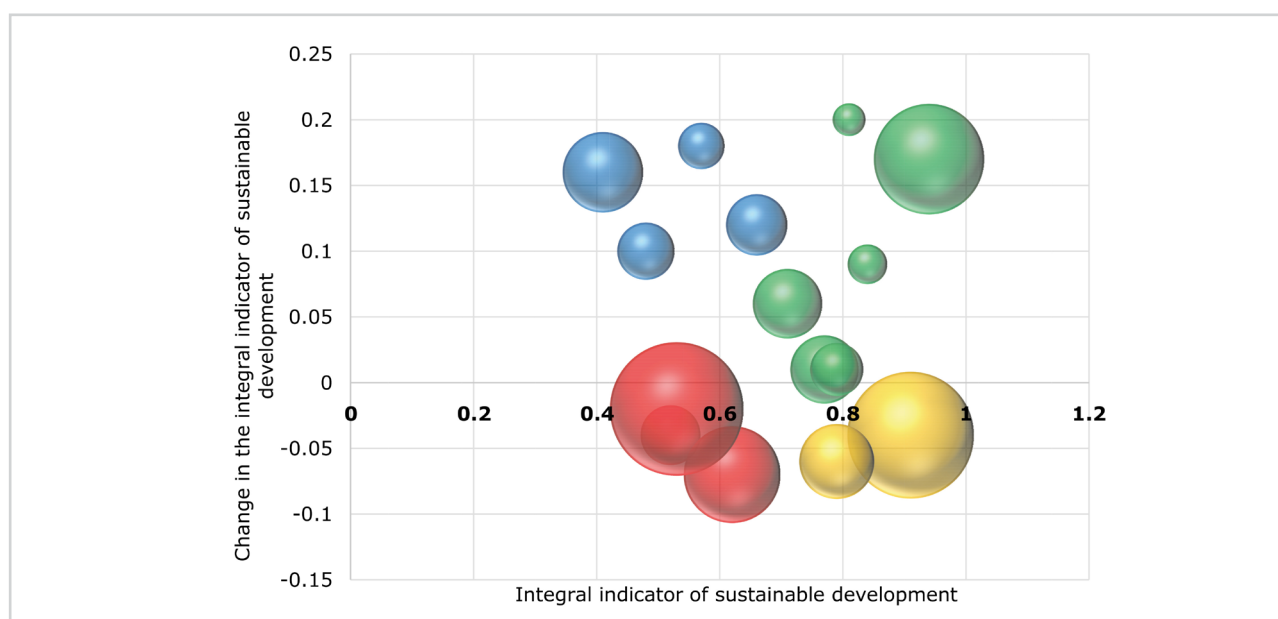
Note: the diameter of the circle depends on the indicator of balance; green - enterprises of the first group; blue - of the second group; yellow - of the third group; red - of the fourth group.

Figure 3:
Diagnostic map of sustainable development of enterprises and the balance of its determinants
Source: Author's own research

development (indicators are above the average but with a decrease in comparison with the previous year). The fourth group includes lagging enterprises with a reduced indicator of sustainable development, while the value is below the average.

Of all surveyed enterprises, 40% belonged to the leading group, the average degree of balance was 0.46, which corresponds to a low level. This average indicator is due to the low degree of balance in three out of six enterprises. The second largest group was the group of catching-up enterprises (26.7%). The average degree of balance of their determinants of sustainable development was 0.45, which was almost identical to the same indicator for the previous group. However, in this case, all enterprises, with the exception of one, were initially characterized by a low degree of balance. The group that was losing the potential for sustainable development included 13.3% of enterprises with an average balance level of 0.74, which corresponded to the medium level. Among all surveyed enterprises, 20% were lagging behind, that is, with an indicator of sustainable development below the average and with a reduction in it. The average degree of balance of the determinants is 0.71. If we exclude from the calculation the enterprise with a low balance, its average level for this group could rise to the high one.

Thus, the highest average value of the balance of economic, social, environmental, and information sustainability by the criteria is typical of the group of enterprises that are losing their potential for sustainable development, and the lowest, for the group of catching-up enterprises. Note that the average value of the balance of the leading enterprises differs very slightly from that of the catching-up group. The maximum value of the balance indicator is typical of an enterprise in the lagging group. The minimum balance was observed in an enterprise from the group of leaders. The results obtained confirm the conclusions made at the previous stage of the analysis: enterprises striving to achieve the highest possible level of sustainable development achieve their goal, as a rule, owing to several determinants and criteria. In this regard, they cannot be considered as fully complying with the principles of sustainable development. This is indirectly confirmed by the fact that the degree of balance of the determinants is higher for enterprises with a level of sustainability above the average but with negative dynamics of the integral indicator.

4. Conclusion

The study showed that a comprehensive diagnostic of sustainable development of enterprises should not be limited to assessing its level, but should also include an assessment of the balance of determinants, the indicators for which, in fact, formed it. This need is further increased by several criteria (reliability, dynamism, acceptability) by which the sustainability of the components is assessed. It is also necessary to take into account the increased number of the components of sustainable development themselves, which are proposed to be transformed into a tetrad at the expense of the informational determinant.

In such a variety of indicators (four components by three criteria), it is necessary to have a correction coefficient that allows the most reliable characterization of an enterprise from the standpoint of sustainable development. When calculating the integral indicator, a compensation mechanism may be activated: low sustainability for some determinants and criteria may not be perceived seriously enough since high sustainability for other determinants and criteria allowed the enterprise to reach a fairly high overall level. Management must adhere to the principle of balanced sustainable development; otherwise, such gaps in managerial decision-making may lead to the loss of the target vector in the future.

The implementation of the proposed methodology for assessing the balance has shown that in almost 100% of cases the level of sustainable development does not coincide with the degree of balance of economic, social, environmental, and information sustainability by the criteria of reliability, dynamism, and acceptability. The difference between the integral indicator of sustainable development and the indicator of balance (taking into account the same range and qualitative interpretation) in some cases reached almost 0.6 units. In accordance with the results obtained, a high level of sustainable development can be achieved by enterprises against the background of a low and even critical balance of its determinants. In addition, as enterprises abandon the goal of achieving the maximum level of sustainable development, the degree of balance of its determinants increases.

This fully confirms the hypothesis of the study: independent assessment of the integral indicator does not allow identifying the real vector of the enterprise development. If an enterprise plans

to adhere to it in the long term, the assessment of the level of sustainable development, together with the assessment of balance by determinants and criteria, should be carried out constantly.

The developed methodology for assessing the balance can be applied in various industries. Specific features and constraints (industry and country) are related only to standards for economic, social, environmental and information indicators. However, these standards are necessary exclusively for assessing sustainable development, and not for balancing its determinants.

References

1. Aroshidze, A. (2020). Social component of sustainable enterprise development. Kreativnaya ekonomika (Creative Economy), 14(5), 869-884. http://doi.org/10.18334/ce.14.5.100946 (in Rus.)
2. Bajdor, P., & Pawełoszek, I. (2020). Data Mining Approach in Evaluation of Sustainable Entrepreneurship. Procedia Computer Science, 176, 2725-2735. https://doi.org/10.1016/j.procs.2020.09.284
3. Chang, A.-Y., & Cheng, Y.-T. (2019). Analysis model of the sustainability development of manufacturing small and medium- sized enterprises in Taiwan. Journal of Cleaner Production, 207, 458-473. https://doi.org/10.1016/j.jclepro.2018.10.025
4. Chang, R.-D., Zuo, J., Zhao, Z.-Y., Soebarto, V., Lu, Y., Zillante, G., & Gan, X.-L. (2018). Sustainability attitude and performance of construction enterprises: A China study. Journal of Cleaner Production, 172, 1440-1451. https://doi.org/10.1016/j.jclepro.2017.10.277
5. Çolak, M. S. (2020). A new multivariate approach for assessing corporate financial risk using balance sheets. Borsa Istanbul Review, 21(3), 239-255. https://doi.org/10.1016/j.bir.2020.10.007
6. Da Costa Ferreira, A. M. S. (2017). How managers use the balanced scorecard to support strategy implementation and formulation processes. Tékhne, 15(1), 2-15. https://doi.org/10.1016/j.tekhne.2017.04.001
7. Dey, P. K., Petridis, N. E., Petridis, K., Malesios, Ch., Nixon, J. D., & Ghosh, S. K. (2018). Environmental management and corporate social responsibility practices of small and medium-sized enterprises. Journal of Cleaner Production, 195, 687-702. https://doi.org/10.1016/j.jclepro.2018.05.201
8. Guix, M., & Font, X. (2020). The Materiality Balanced Scorecard: A framework for stakeholder-led integration of sustainable hospitality management and reporting. International Journal of Hospitality Management, 91, 102634. https://doi.org/10.1016/j.ijhm.2020.102634
9. Gurova, I. (2020). Remote Work as a Trend of Time: Results of Mass Testing. Mir (Modernizaciya. Innovacii. Razvitie) (MIR (Modernization. Innovation. Research)), 11(2), 128-147. https://doi.org/10.18184/2079-4665.2020.11.2.128-147 (in Rus.)
10. He, J., Nazari, M., Zhang, Y., & Cai, N. (2020). Opportunity-based entrepreneurship and environmental quality of sustainable development: A resource and institutional perspective. Journal of Cleaner Production, 256, 120390. https://doi.org/10.1016/j.jclepro.2020.120390
11. Hong, P., Jagani, S., Kim, J., & Youn, S. H. (2019). Managing sustainability orientation: An empirical investigation of manufacturing firms. International Journal of Production Economics, 211, 71-81. https://doi.org/10.1016/j.ijpe.2019.01.035
12. Hsu, Ch., Jin, Q., Ma, Zh., & Zhou, J. (2021). Does voluntary balance sheet disclosure mitigate post-earnings-announcement drift? Journal of Accounting and Public Policy, 40(2), 106821. https://doi.org/10.1016/j.jaccpubpol.2021.106821
13. Ike, M., Donovan, J. D., Topple, Ch., & Masli, E. K. (2019). The process of selecting and prioritising corporate sustainability issues: Insights for achieving the Sustainable Development Goals. Journal of Cleaner Production, 236, 117661. https://doi.org/10.1016/j.jclepro.2019.117661
14. Klapper, R. G., & Farber, V. A. (2016). In Alain Gibb's footsteps: Evaluating alternative approaches to sustainable enterprise education (SEE). The International Journal of Management Education, 14(3), 422-439. https://doi.org/10.1016/j.ijme.2016.09.001
15. Kleiner, G. B., & Rybachuk, M. A. (2019). System Balance of the Russian Economy: Regional Perspective. Ekonomikaregiona (Economy of Region), 15(2), 309-323. https://doi.org/10.17059/2019-2-1 (in Rus.)
16. Kolk, A. (2016). The social responsibility of international business: From ethics and the environment to CSR and sustainable development. Journal of World Business, 51(1), 23-34. https://doi.org/10.1016/j.jwb.2015.08.010
17. Lee, C. V. J., Che-Ha, N., & Alwi, Sh. F. S. (2021). Service customer orientation and social sustainability: The case of small medium enterprises. Journal of Business Research, 122, 751-760. https://doi.org/10.1016/j.jbusres.2019.12.048
18. Liu, S. Y. H., Napier, E., Runfola, A., & Cavusgil, S. T. (2020). MNE-NGO partnerships for sustainability and social responsibility in the global fast-fashion industry: A loose-coupling perspective. International Business Review, 29(5), 101736. https://doi.org/10.1016/j.ibusrev.2020.101736
19. Lu, M.-T., Hsu, Ch.-Ch., Liou, J. J. H., & Lo, H.-W. (2018). A hybrid MCDM and sustainability-balanced scorecard model to establish sustainable performance evaluation for international airports. Journal of Air Transport Management, 71, 9-19. https://doi.org/10.1016/j.jairtraman.2018.05.008
20. Makrelov, K., Arndt, Ch., Davies, R., & Harris, L. (2020). Balance sheet changes and the impact of financial sector risk-taking on fiscal multipliers. Economic Modelling, 87, 322-343. https://doi.org/10.1016/j.econmod.2019.08.006
21. Matinaro, V., Liu, Y., Lee T.-R., & Poesche, J. (2019). Extracting key factors for sustainable development of enterprises: Case study of SMEs in Taiwan. Journal of Cleaner Production, 209, 1152-1169. https://doi.org/10.1016/j.jclepro.2018.10.280
22. Nath, S., & Sandholm, T. (2019). Efficiency and budget balance in general quasi-linear domains. Games and Economic Behavior, 113, 673-693. https://doi.org/10.1016/j.geb.2018.11.010

23. Ndubuka, N. N., & Rey-Marmonier, E. (2019). Capability approach for realising the Sustainable Development Goals through Responsible Management Education: The case of UK business school academics. The International Journal of Management Education, 17(3), 100319. https://doi.org/10.1016/j.ijme.2019.100319

24. Nicoletti J. A., de Oliveira, M. C., & Helleno, A. L. (2018). Sustainability evaluation model for manufacturing systems based on the correlation between triple bottom line dimensions and balanced scorecard perspectives. Journal of Cleaner Production, 190, 84-93. https://doi.org/10.1016/j.jclepro.2018.04.136

25. Prashar, A. (2019). Towards sustainable development in industrial small and Medium-sized Enterprises: An energy sustainability approach. Journal of Cleaner Production, 235, 977-996. https://doi.org/10.1016/j.jclepro.2019.07.045

26. Prashar, A., & Sunder M, V. (2020). A bibliometric and content analysis of sustainable development in small and medium-sized enterprises. Journal of Cleaner Production, 245, 118665. https://doi.org/10.1016/j.jclepro.2019.118665

27. Quezada, L. E., Reinao, E. A., Palominos, P. I., & Oddershede, A. M. (2019). Measuring Performance Using SWOT Analysis and Balanced Scorecard. Procedia Manufacturing, 39, 786-793. https://doi.org/10.1016/j.promfg.2020.01.430

28. Sanchez-Marquez, R., Guillem, J. M. A., Vicens-Salort, E., & Vivas, J. J. (2018). A statistical system management method to tackle data uncertainty when using key performance indicators of the balanced scorecard. Journal of Manufacturing Systems, 48(part A), 166-179. https://doi.org/10.1016/j.jmsy.2018.07.010

29. Slavík, J., Pavel, J., & Arltová, M. (2020). Variable charges and municipal budget balance: Communicating vessels of the waste management. Journal of Environmental Management, 257, 109976. https://doi.org/10.1016/j.jenvman.2019.109976

30. Sokil, O., Zvezdov, D., Zhuk, V., Kucherkova, S., & Sakhno, L. (2020). Social and environmental costs: the impact of accounting and analytical support on enterprises' sustainable development in Germany and Ukraine. Economic Annals-XXI, 181(1-2), 124-136. https://doi.org/10.21003/ea.V181-11

31. Stål, H. I., & Babri, M. (2020). Educational interventions for sustainable innovation in small and medium sized enterprises. Journal of Cleaner Production, 243, 118554. https://doi.org/10.1016/j.jclepro.2019.118554

32. Stekelorum, R., Laguir, I., & El Baz, J. (2020). Can you hear the Eco? From SME environmental responsibility to social requirements in the supply chain. Technological Forecasting and Social Change, 158, 120169. https://doi.org/10.1016/j.techfore.2020.120169

33. Trianni, A., Cagno, E., Neri, A., & Howard, M. (2019). Measuring industrial sustainability performance: Empirical evidence from Italian and German manufacturing small and medium enterprises. Journal of Cleaner Production, 229, 1355-1376. https://doi.org/10.1016/j.jclepro.2019.05.076

34. Veronica, S., Alexeis, G.-P., Valentina, C., & Elisa, G. (2020). Do stakeholder capabilities promote sustainable business innovation in small and medium-sized enterprises? Evidence from Italy. Journal of Business Research, 119, 131-141. https://doi.org/10.1016/j.jbusres.2019.06.025

35. Vertakova, Yu., & Plotnikov, V. (2017). Problems of sustainable development worldwide and public policies for green economy. Economic Annals-XXI, 166(7-8), 4-10. https://doi.org/10.21003/ea.V166-01

36. Wong, D. T. W., & Ngai, E. W. T. (2021). Economic, organizational, and environmental capabilities for business sustainability competence: Findings from case studies in the fashion business. Journal of Business Research, 126, 440-471. https://doi.org/10.1016/j.jbusres.2020.12.060

37. Xu, B., Costa-Climent, R., Wang, Y., & Xiao, Y. (2020). Financial support for micro and small enterprises: Economic benefit or social responsibility? Journal of Business Research, 115, 266-271. https://doi.org/10.1016/j.jbusres.2020.01.071

38. Yuan, B., & Zhang, Y. (2020). Flexible environmental policy, technological innovation and sustainable development of China's industry: The moderating effect of environment regulatory enforcement. Journal of Cleaner Production, 243, 118543. https://doi.org/10.1016/j.jclepro.2019.118543

39. Zhang, Q., Oo, B. L., & Lim, B. T. H. (2019). Drivers, motivations, and barriers to the implementation of corporate social responsibility practices by construction enterprise: A review. Journal of Cleaner Production, 210, 563-584. https://doi.org/10.1016/j.jclepro.2018.11.050

40. Zhang, Y., & Cui, M. (2020). The impact of Corporate Social Responsibility on the enterprise value of China's listed coal enterprises. The Extractive Industries and Society, 7(1), 138-145. https://doi.org/10.1016/j.exis.2019.11.010

41. Zhou, M., Govindan, K., & Xie, X. (2020). How fairness perceptions, embeddedness, and knowledge sharing drive green innovation in sustainable supply chains: An equity theory and network perspective to achieve sustainable development goals. Journal of Cleaner Production, 260, 120950. https://doi.org/10.1016/j.jclepro.2020.120950