

Under modern conditions, there are new requirements for the formation of relations with consumers, partners, employees, and society.

The possibilities of integrating corporate social responsibility (CSR) tools and economic digitalization processes have been investigated and a new format for evaluating the activities of small and medium-sized businesses related to their level of maturity has been defined.

This study formulates patterns of CSR development, proposes the use of a new concept of “digital space of social sustainable development” (DSSSD), and reports a methodological toolkit devised for determining the level of maturity of the digital space of social sustainable development (DSSSD) of food industry enterprises. The developed methodological support makes it possible to assess CSR by economic, social, and informatization criteria.

The proposed CSR scorecard makes it possible to compare companies and rank them in the coordinate system of corporate social responsibility/digitalization. 17 key indicators have been identified, which are formed into three key groups. Confirmation of the effectiveness of the methodology is the execution of calculations for small and medium-sized businesses in the food industry. According to the results of the calculations, the maturity levels of eight enterprises of the food industry in Ukraine in the DSSSD space were determined.

The analysis made it possible to determine that four enterprises are at the initial level of DSSSD (zone 1 Digital Descriptive), two enterprises are moving to zone 2 (Solutions Analytics Digital), and two enterprises are in a state of transition to zone 3 (Smart CIS) due to increasing the level of digitalization and the formation of an internal CSR system, which indicates their active development. This makes it possible to assert that the technique is effective and can be useful for enterprises around the world. The selected indicators are used at all enterprises of those countries that use the international accounting and reporting system.

Improving the system in the areas of formation of corporate social responsibility and the introduction of digitalization of the enterprise makes it possible to optimize the information systems of enterprises, automate management procedures, and create new communication channels with consumers and beneficiaries. This will contribute to the development of a systemic socio-economic effect of business, care for the needs of people, the development of the social climate at an enterprise, and the emergence of new formats of interaction between business, the state, and society

Keywords: corporate social responsibility, digitalization of business, digital space of sustainable development, digitalization, area of maturity of the enterprise

UDC 65.012.61:316.77

DOI: 10.15587/1729-4061.2022.263540

CREATING A DIGITAL SPACE OF SOCIALLY SUSTAINABLE DEVELOPMENT FOR FOOD ENTERPRISES

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Received date 24.06.2022

Accepted date 22.08.2022

Published date 31.08.2022

How to Cite: Lingur, L., Martyniuk, O., Ivchenko, I., Ivchenko, O. (2022). Creating a digital space of socially sustainable development for food enterprises. *Eastern-European Journal of Enterprise Technologies*, 4 (13 (118)), 22–33. doi: <https://doi.org/10.15587/1729-4061.2022.263540>

1. Introduction

Under modern conditions, new business models are defined, in which new requirements for the formation of relationships with consumers, partners, workers, stakeholders, and society appear. It is the new standards of relationships that are becoming one of the priority areas for the development of competitiveness, such standards at the present stage include the standards of corporate social responsibility (CSR).

The development of the degree of social responsibility is determined through competitive advantages, namely, through the definition of environmental phenomena and determining the quality of the processes of the internal environment in the organization, which undoubtedly affects the change in competitiveness. The urgency of the problem of CSR assessment is that business is aware of the impor-

tance of implementing the CSR philosophy, identifying new approaches to the development of the digital society and the digital economy. The results of such studies provide opportunities for assessing the costs of introducing CSR into the internal information systems of enterprises. It also makes it possible to correlate the level of development of information technologies of the enterprise with its needs and capabilities, and to determine their impact on production technologies, socialization of workers, and efficiency of the enterprise as a whole.

The global pandemic has shown that most of the enterprises that have reoriented to the consumer segment in the digital space have maintained their position in the market, and some have begun to develop new directions. This topic is becoming especially relevant now, as a global recession is predicted and, as a result, a global crisis is approaching. As a result of these macroeconomic processes, intensive processes

of transformation of socio-ethical, humanistic, managerial concepts began to take place. Therefore, the definition of the process of integrating CSR tools into business activities in the context of digitalization of the economy is one of the most relevant areas of research for the development of business management in the world.

Scientific studies into the impact of CSR on the development of countries, the development and implementation of national sustainable development strategies are constantly being improved. However, the main problem is that there is no systematic methodology for determining CSR, recommendations for determining a sufficient level of CSR implementation, comparative criteria for reaching the level of CSR. All this slows down the introduction of CSR standards in the overall management system of enterprises around the world. There are practically no methodological developments for assessing the impact of informatization of enterprises' activities on the level of CSR.

Therefore, studies that address the level of implementation and effectiveness of CSR standards and digitalization processes into a common criterion "digital space of social sustainable development" (DSSSD) should be considered relevant. The appropriate methodology would allow the company to quickly identify problem areas in the economic, social, informatization state of the enterprise and select the vectors of further development with minimal expenditure of resources and time.

2. Literature review and problem statement

In world science, CSR research is distinguished as a separate interdisciplinary scientific area. Scientists consider such issues as sustainable development, business ethics, corporate governance, interaction with stakeholders, the impact of international institutions and standards, legislative problems, etc.

In [1], the concept of the digital economy for building a national development strategy is considered. However, the main factor in digitalization is payment systems. This approach practically does not take into consideration the level of informatization of management processes, and the responsibility of business at the micro level.

Current trends in modern society have actively influenced the processes of development and transformation of the concept of CSR [2, 3], taking into consideration the goals of global sustainable development. At the micro level, the social functions of entrepreneurship affect the economic function (making a profit). At the state level, national labor legislation is slowly changing in the direction of international standards and norms of social responsibility. However, the active development of the Internet gives rise to new forms of business models, business communications, the impact of which on the social responsibility of business is difficult to predict.

In world management, CSR is investigated as the development of responsible business practices that benefit business and society. Thus, the author of work [4] cites a system of CSR indicators but they do not correlate with each other, the assessment is carried out only by expert means through a survey. The basic criterion on which the system of indicators is built is the life cycle of the enterprise. However, it is not always possible to establish for certain at what stage of

development the enterprise is, which makes it difficult to determine the state of the enterprise.

The authors of papers [5, 6] believe that CSR should be regulated through institutional laws and regulations, and an appropriate governing body in the government should be created. This will make it possible to fight against corruption and monopolies. However, in developed European countries, small and medium-sized businesses own 70–75 % of the market, and it is important for them to be able to create their own unique digital brand. This is especially true of food enterprises whose products are related to human health and life.

Works [7, 8] also consider the levels of maturity of the enterprise but in the context of management and technological maturity, the concept of ranking the enterprise is formed. The disadvantage of the work is that the level of CSR is not taken into consideration and the digitalization of business is not considered as one of the key elements of the development of a modern enterprise.

The analysis of practical aspects of system architecture engineering was carried out under the auspices of such organizations as The Open Group, DoDAF, Institute For Enterprise Architecture Developments, etc. The Zachman model was used in the development of indicators of the socio-economic group but it is not a methodology since it does not imply specific methods [9, 10]. Therefore, it is correct to define the Zachman model as an ontology, a scheme for organizing architectural artifacts (design documents, specifications, models) used in the study.

When conducting a comparative analysis of boundary parameters, the base selected was the development of world and Ukrainian analytical data [11, 12] on global trends in the development of CSR and IT trends. The reliability of analytical data is guaranteed by large think tanks. As a comparative study, the reports of the international audit company KMPG were used to consider the problems and shortcomings that arose for enterprises of different sizes and forms of ownership.

The studies of the design of enterprise architecture, the formation of the methodology for building architecture and supporting information systems in the activities of enterprises and organizations are reported in [13, 14]. In [13], the main aspects of the formation of the information security system of the enterprise are determined, but only generalized threats, generalization of methods of information protection and the main functions of the IT security service are highlighted. However, food processing enterprises must have another level of information security, such as technology security. In the digital space, it is very easy to form an anti-trend, black PR of the company, so in the work we introduce such indicators as the coefficient of environmental friendliness of production, the coefficient of assistance in improving product quality. In [14], the author highlighted separate approaches to the formation of the CSR information system for small and medium-sized businesses.

Global information and technological development is rapidly changing socio-economic processes, which requires updating theoretical research and practical recommendations on the tasks of modeling and organizing the management system of the business architecture of the enterprise.

The logical result of studying the concept of CSR is the creation of a comprehensive model that takes into consider-

ation aspects of business development in the context of digitalization, established concepts that inherit or complement each other. At the present stage of development of society and NTP, we can talk about the creation of a new concept of CSR. It will include a system of voluntary action, cross-cultural, social, environmental, and economic nature.

3. The aim and objectives of the study

The aim of this study is to determine the patterns of CSR development under the conditions of digitalization of the economy and the formulation of methodological tools for determining the level of maturity of the digital space of socially sustainable development of food industry enterprises. This will enable automated control, analytics, and a combination of financial, economic, and socio-environmental indicators to optimize CSR information systems of food enterprises.

To accomplish the aim, the following tasks have been set:

- to systematize the existing forms and tools for the implementation of CSR under the conditions of digitalization of the economy;
- to develop a system of indicators for determining the level of the internal system of corporate social responsibility for small and medium-sized businesses, taking into consideration the digitalization of the enterprise;
- to develop a scientific and methodological approach to determining the level of maturity of the digital space of the socially sustainable space of small and medium-sized businesses.

4. The study materials and methods

The object of this study is the process of integrating CSR tools in the context of digitalization of the economy into the activities of small and medium-sized businesses.

The research was conducted on the basis of a systematic approach to the analysis of socio-economic phenomena and processes, modern scientific trends, and theories of development of standards and the philosophy of social responsibility of business in the context of world digitalization of the economy. To solve the outlined problems, we used methods of system analysis, taxonomic and statistical analysis, a package of applications Microsoft Excel (USA) and a package for statistical analysis STATISTICA (USA).

The current stage of development of corporate social responsibility is noted as a stage of special responsibility of managers in the implementation of the company's external and internal policy [5, 6]. A characteristic feature of the modern period is manifested in the fact that this stage of development of social responsibility of business is associated with the emergence of globalization processes and the emergence of various information technologies. In addition, many managers began to realize that the profitability of a business depends not only on economic efficiency but also on the readiness of companies to declare and implement moral and ethical standards in the standards of corporate culture, and to establish humanistic values in the company's mission.

Scientific studies into the stages of CSR business formation have made it possible to determine the following scientific hypothesis: under the conditions of rapid global

digitalization of the business space, it is necessary to form an information system based on CSR tools. It will combine the requirements and needs of the external environment for global sustainable development, greening production, safe and cybersecurity-based human development, with the possibility of creating a socio-ethical business. And this involves the development of methodological tools and a model of such an IT system of corporate social responsibility (CSR), which will unite all needs and provide conditions for creating a digital space for socially sustainable development.

The realities of modern business determine that the development of information technology directly affects the growth of business indicators of enterprises. Therefore, the introduction of information technology and the definition of the most adapted business models for use opens up a wide range of competitive opportunities. Under the conditions of transition from the industrial to the information society, information technologies must meet the following requirements [14]:

- to ensure the implementation of the processes of document circulation and information processing according to the criteria of their effectiveness;
- include a complete set of information processing units and hardware and software to support IT processes;
- have a flexible organizational structure that should ensure the planning and regulation of information processing processes;
- apply methods of implementation and control of business processes from the standpoint of their optimal design;
- to adhere to the functional-subject order of introduction of information technologies, as well as their use as a basis for adaptation of automation tools;
- give precedence to the introduction of advanced information technologies, modern IT solutions and the use of IT services.

According to the consultancy Gartner [2], by 2025 there is a proliferation of voice interfaces, the Internet of Things (IoT) and chatbots, the democratization of artificial intelligence (AI). However, the development of information technology will lead to the emergence of a record amount of unverified information, which encourages a rethinking of the format of activities of large technology corporations [11, 15].

To analyze the internal resources of the enterprise, it is proposed to use the taxonomy method to determine the level of solvency of the enterprise by combining the main indicators of the liquidity of the enterprise and the ratio of coverage of stocks, own working capital [16]. Other researchers used the taxonomy method to analyze the financial security of a bank, therefore, the use of taxonomic analysis to assess economic phenomena has found wide application in the modern economy [17, 18].

5. Results of studying the formation of the digital space of socially sustainable development of food enterprises

5.1. Systematization of forms and tools for the implementation of corporate social responsibility under the conditions of digitalization of the economy

The formation of methodological tools takes place on the basis of integration, analysis, and processing of information flows: flows of the internal environment and flows of the external environment. Forms and tools of implementation

correspond to the external and internal manifestation of CSR and are given in Table 1.

Table 1
Forms and tools for implementing corporate social responsibility

Internal form of CSR implementation	External form of CSR implementation
1. Development and support of personnel: – employee adaptation programs; – participation of employees in management decisions; – improvement of the qualification level; formation of corporate culture	1. Environmental protection activities: – measures for reuse and disposal of waste; – reducing the harmful impact of production activities on the environment
2. Labor protection: – maintenance of sanitary working conditions; – provision of medical and preventive measures; – prevention of occupational diseases; – creation of workplaces that meet all standards and requirements; – medical care for company personnel and their family members	2. Development of the local community: – sponsorship of sports organizations and local cultural and educational events; – implementation of social projects, actions; – support of NGOs; – support of scientific and applied research in the social direction; – active participation in charity events; – preservation and development of housing and communal services and objects of cultural and historical significance
3. Socially responsible restructuring: – organization and implementation of employee retraining and retraining programs; – preservation of social benefits for a certain period of time after dismissal; – reorganization of labor processes; – economically justified reduction of jobs; – assistance with employment; – availability of compensation payments; – rejection of non-ecological types of activities	3. Development of conscientious business practices: – implementation of programs on voluntary limitation of business spheres; – organization of programs for the development and promotion of small and medium-sized enterprises; – joint holding of events with state administration bodies, consumer associations, and other public organizations; – transparency towards owners, suppliers, business partners, customers, and stakeholders

As can be seen from Table 1, the internal form of CSR implementation is expressed through the tools of the company's internal socially responsible policy in relation to the staff to its owners. The programs implemented within its framework are related to health care and the creation of safe working conditions, staff development, solving issues of social restructuring, as well as improving the efficiency of doing business.

The external form of CSR is a social policy of the company in relation to the local community and other external stakeholders, includes programs aimed at environmental activities, the development of the territory of presence. Social programs that meet the internal goals of organizations do not provide for the involvement of external partners (non-profit organizations, public associations, authorities)

but are limited to the sphere of influence of professional organizations (professional associations and trade unions). Thus, it becomes necessary to form a methodology for determining the degree of introduction of elements of corporate social responsibility in the activities of the enterprise, as well as determining the possibility of integrating them into IP enterprises. It is also necessary to determine how the enterprise is integrated into the space of the digital business.

5. 2. Development of a system of indicators for determining the level of the internal system of corporate social responsibility, taking into consideration the digitalization of the enterprise

Existing methods for assessing the level of CSR are aimed at identifying the impact of enterprise CSR on the external environment. Most often, three areas of research remain key: economic, environmental, and social areas. Under the conditions of digitalization of the economy, the approaches do not provide a general idea of the ratio of money and time and profit, strengthening the position of the enterprise, increasing the value of the share, etc.

For a qualitative assessment of the level of CSR of an enterprise, it is necessary to consider the tools of influence on the internal and external environment as a set of measures, their mutual penetration. To conduct a comprehensive assessment of the level of CSR, it is necessary to use both the financial statements of enterprises and non-financial, informational, public, which have either an expert assessment or integral.

This assessment technique involves the use of data from open sources. The proposed scorecard is grouped into 3 groups and developed on the basis of the methodology for assessing the social activity of food industry enterprises of small and medium-sized businesses. The selection criterion is based on the informativeness of indicators, as well as their availability in open sources [4, 7, 13, 14]. Thus, to assess the digital space of sustainable social development of enterprises, it is proposed to form all indicators into three groups:

- 1) socio-economic group;
- 2) socio-ecological groups;
- 3) social-informatization group.

As input data, information from open sources on financial and non-financial statements of Ukrainian enterprises was used.

It should be noted that most of the indicators are standard indicators, which are calculated according to the analytical reporting of SME (o) standards, which have been joined by 198 countries of the world. Individual indicators are calculated in large corporations in isolation, and individual indicators are calculated independently according to the standards of internal corporate policy.

Methodological support of indicators for determining the assessment was investigated from the standpoint of the influence of CSR on the system of internal indicators based on three groups: socio-economic group, socio-ecological, and socio-informatization group (Table 2).

The group of economic indicators makes it possible to determine on the basis of standard international indicators (ROE, ROS) and others the level of economic stability of the enterprise and its propensity for development. Economic indicators include the size of social investment per employee, the ratio of social investment to profit and much more [4]. For example, the coefficient of social pay growth takes into consideration the improvement of working conditions of

employees and their level of qualifications. It includes the same indicators as staff turnover, the qualification ratio of workers, the ratio of the average wage in the enterprise to the indicator in the region.

Table 2

Indicators of comprehensive assessment of corporate social responsibility

Indicator title	Designation	Indicator assessment	Index value
Socio-economic group			
1. Profitability of capital	ROE	Stimulator	SEcK ₁
2. Profitability of implementation	ROS	Stimulator	SEcK ₂
3. Accounts payable ratio	K_{PRP}	Destimulator	SEcK ₃
4. Accounts payable ratio for goods and services	K_{PRg}	Destimulator	SEcK ₄
5. Coefficient of socially responsible payment	K_{SRP}	Stimulator	SEcK ₅
6. Coefficient of social growth of payment	K_{SPGR}	Stimulator	SEcK ₆
7. Staff retention rate	K_{SCR}	Stimulator	SEcK ₇
8. Coefficient of social growth	K_{SGR}	Stimulator	SEcK ₈
Socio-ecological group			
9. Coefficient of social security of a person	K_{HSS}	Stimulator	SEnK ₁
10. Coefficient of social partnership	K_{SP}	Stimulator	SEnK ₂
11. Coefficient of environmental friendliness of production	K_{EFP}	Destimulator	SEnK ₃
12. Coefficient of promotion of product quality improvement	K_{PQ}	Stimulator	SEnK ₄
Social and informatization group			
13. Coefficient of software-ization	K_{SI}	Stimulator	SInK ₁
14. Coefficient of informatization of management procedures	K_{MPI}	Stimulator	SInK ₂
15. Coefficient of informatization of equipment, devices	K_{EDI}	Stimulator	SInK ₃
16. CSR Transparency and Accountability Index	I_{TA}	Stimulator	SInK ₄
17. Index of digitization of the enterprise	I_{ED}	Stimulator	SInK ₅

The group of socio-environmental indicators makes it possible to estimate in a coefficient terms the level of social security of a person, the degree of social partnership, the environmental friendliness of production, and the coefficient of promoting the improvement of product quality [6]. For example, the coefficient of social partnership is an integral indicator that takes into consideration the participation of employees in decision-making, collective bargaining, in the distribution of profits, etc.

Calculations of environmental indicators highlight cases of exceeding environmental standards, the number of violations of technological regulations. Social indica-

tors include staff turnover, labor shortage, assessment of the company's contribution to the social sphere. For example, the coefficient of assistance in improving product quality takes into consideration the introduction of modern quality standards, is a generalizing indicator of the quality of the company's products, is used in the global economy [6].

The group of socio-information indicators was calculated on the basis of expert assessments using indicators proposed by international corporations Oracle, IBM, Gartner Supply Chain, and others.

The level of software characterizes the availability of own developments or vendor products for automating various areas of enterprise activity (management, marketing, enterprise finance, production, logistics, etc.). It will make it possible to assess the degree of internal informatization and quality of enterprise software.

Informatization of management procedures determines the presence of an administrative information system (own WEB-pages, portals, chats, instant messengers). This indicator affects the quality, speed, and efficiency of interaction with counterparties, consumers, and beneficiaries. It also makes it possible to control internal communications and management processes within the company.

The CSR Transparency and Accountability Index is determined according to the international protocol International Standard ISO 26000:2010, it is calculated only in those companies that have signed an agreement on compliance with CSR standards. In Ukraine, the number of such companies is about 10 %, in European countries this figure fluctuates around 50–60 %, in the USA and Japan this figure is 70–80 % of companies that adhere to the ISO standard protocol.

5.3. Development of a scientific and methodological approach to determining the level of maturity of the digital space of socially sustainable development of enterprises

The method of correlation of groups of indicators provides an opportunity to investigate the level of maturity of the enterprise according to the integral indicator DSSSD in the vector direction: digitalization/CSR. To calculate the integral indicator DSSSD, taxonomic analysis methods were used, according to the results of which the rating of eight food industry enterprises was determined.

A comprehensive assessment of the internal CSR system encourages the need to simultaneously take into consideration heterogeneous characteristics that cannot be compared with each other both in units of measurement and in absolute values. For example, the return on capital and the coefficient of constancy of personnel differ by several orders of magnitude in absolute value and at the same time turn out to be incomparable in economic content [8, 14].

The practice of comparing heterogeneous actual parameters that affect the calculation of a comprehensive CSR assessment is quite complicated and branched. From the point of view of the objectives of the analysis, the number of parameters and signs, such objects can be combined with the general concept of «multidimensional object». A comprehensive assessment of corporate social responsibility, which is the object of research, can also be defined as a typical multidimensional object.

The task of evaluation can be reduced to the problem of ordering multidimensional objects and determining the «best» of them, which makes it possible to apply taxonomic procedures to solve this problem.

The basis of taxonomic estimates is the main hypothesis: the closer to each other the values of the signs of two objects, the closer the properties of these objects.

To form a comprehensive table, an economic detailed analysis was carried out for each individual object of the study in accordance with the economic, social, and informatization analytics provided by enterprises.

The found distances make it possible to determine the position of each point relative to other points, to perform their ordering and classification. However, the dimensions of the signs of multidimensional points, as a rule, are different, which does not make it possible to compare their values directly. In addition, the absolute values of the signs may differ by several orders of magnitude, for example, the coefficient of social security of a person and the index of digitalization of the enterprise. In this case, the accounting of signs with a small value will practically not affect the result of the calculations.

Thus, to assess the degree of similarity or difference of objects, it is necessary to find the distance between objects in the space of the coordinates of the signs. The taxonomic distance is calculated either between points – units, or between points – features, but each time located in a multidimensional space.

To eliminate such shortcomings, it is enough to standardize the signs by moving to their normalized dimensionless values (Z_{ij}), which have a zero value of the mathematical expectation and the arithmetic mean of the variance and the quadratic mean deviation.

In general, a standard taxonomic analysis algorithm was used [19].

The initial step necessary for taxonomic procedures is the formation of a matrix of observations of X dimensionality ($m \times n$), in each row of which the values of all n signs of a particular i -th unit (1) are recorded:

$$X_i = (x_{i1}, x_{i2}, \dots, x_{in}); \quad i = 1, \dots, m, \tag{1}$$

To determine the main objectives of the hypothesis, and from the point of view of the objectivity of the study, we identified some factors as stimulants and destimulants (Ta-

bles 3, 4), the numerical values of which either positively or negatively affect the overall result.

The destimulators included the coefficient of accounts payable on accounts, the coefficient of accounts payable for goods and services, the coefficient of environmental friendliness of production, the coefficient of social growth of payment. The main signs in Table 3 describe the different properties of objects, which can be random variables with different variation values, may have different dimensionalities. Therefore, the next step is to standardize the signs by moving to normalized dimensionless values Z_{ij} (2):

$$Z_{ij} = \frac{x_{ij} - m_j}{\sigma_j}; \quad i = 1, \dots, n, \tag{2}$$

where m is the number of units (points of n -dimensional space), which is equal to the number of the matrix rows, n – the number of features of each statistical unit (equal to the number of matrix columns). One column contains the value of one feature (3); x_{ij} – the value of the sign number j for the unit number i , $m_j = \bar{x}_j$ – the definition of the mathematical expectation of the sign X_j :

$$\bar{x}_j = m_j = \frac{1}{m} \sum_{i=1}^m x_{ij}; \quad j = 1, \dots, n. \tag{3}$$

Next, we calculate σ_j – the standard deviation of the sign X_j (4).

$$\sigma_j = \sqrt{\frac{1}{m} \sum_{i=1}^m (x_{ij} - m_j)^2}; \quad j = 1, \dots, n. \tag{4}$$

For each feature, an estimate of the mathematical expectation (3) and the standard deviation (4), which are given in Tables 3, 4, and normalized values (2). The final results of the calculations are given in Table 5. According to the analytical data of enterprises, according to the public financial statements, 17 coefficients were calculated for each of the 8 enterprises for three years.

Next, we calculated σ_j – the standard deviation of the sign X_j (5):

$$\sigma_j = \sqrt{\frac{1}{m} \sum_{i=1}^m (x_{ij} - m_j)^2}; \quad j = 1, \dots, n. \tag{5}$$

Table 3

Input data for taxonomic analysis (Table of objects grouped by weighted average method, according to the results of calculating the indicators of the accounting period 2018–2020)

Object	Indicators of comprehensive assessment							
	SEcK ₁	SEcK ₂	SEcK ₃	SEcK ₄	SEcK ₅	SEcK ₆	SEcK ₇	SEcK ₈
PJSC “Carlsberg Ukraine”	0.67	0.4	0.36	0.14	2.33	221.04	0.99	2.33
PJSC “Obolon”	0.54	0.28	0.45	0.12	2.1	146.16	1	2.33
Odesa Cannery Factory	0.31	0.14	0.26	0.13	1.43	44.63	1	0.86
PJSC Chernivtsi Bread Plant	1.74	0.36	0.59	0.35	0.93	55.5	0.94	0.2
PJSC “YENNY FOODS”	0.1	0.21	0.06	0.01	1.03	33.42	1.05	0.5
PJSC “Odesa Canning Plant for Baby Food”	0.091	0.459	0.025	0.01	1.9	160.942	1.101	4.2
PJSC “Odesa Meat Processing Plant”	5.02	0.18	0.56	0.2	0.8	37.07	1.2	0.1
PJSC “Reni Meat Processing Plant”	0.125	0.24	0.004	0	0.667	9.596	1.189	0.013
$M[X_j]$	1.0745	0.283	0.288	0.12	1.398	88.544	1.058	1.316
σ_j	1.5757	0.105	0.223	0.110	0.598	71.639	0.089	1.399

Note: formed by Authors on the basis of calculations of analytical data of enterprises

The multidimensional indicator chosen in this way, in this case, for the purposes of analysis, is the «standard of development». The distances of each point to the development standard are determined:

$$C_{i0} = \sqrt{\sum_{j=1}^n (z_{ij} - z_{0j})^2}; \quad i = 1, \dots, m. \tag{6}$$

The closer to unity (X_i) is to the reference point of development, the smaller the value of C_{i0} will be. However, the specific value of the distance does not give an unambiguous characteristic of the degree of remoteness of the unit of the population from the ideal point. More informative is the ratio of the distance C_{i0} to the maximum possible value of C_0 in the set of multidimensional research units

$$(d_i^* = c_{i0} / c_0).$$

This ratio is within $d_i^* \in [0;1]$ and automatically reflects the degree of proximity of the i -th unit – the point of the study population to the point of the standard. To go to the indicator d_i , one needs to find a statistical estimate of the value C_0 .

The next stage of the analysis is the average for all units of the value of the distance to the ideal point $M[c_{i0}]$ (estimation of mathematical expectation).

$$M[c_{i0}] = \bar{c}_0 = \frac{1}{m} \sum_{i=1}^m c_{i0}. \tag{7}$$

The value of C_0 is an estimate of the maximum distance and can be found according to the rule of “three sigmas” (8).

$$c_0 = \bar{c}_0 + 3\sigma_0. \tag{8}$$

The completion of the analysis of finding the level of development for each enterprise is (9):

$$d_i = 1 - \frac{c_{i0}}{c_0}. \tag{9}$$

This indicator is interpreted as follows: the i -th unit (X_i) has the greater the level of development, the closer to the unity is the value of the indicator of the level of its development.

The company will act as a reference enterprise, which will receive the highest rating and will have the highest rank. That is, it will fall into the segment of the greatest development.

For convenience, the results of calculations (1) to (9) are given in Tables 5, 6.

The calculation, determined on the basis of taxonomic analysis of factors, made it possible to build a plot of the positioning of enterprises according to the maturity index of the DSSSD indicator for eight food industry enterprises.

Table 4

Input data for taxonomic analysis (Table of objects grouped by weighted average method, according to the results of calculating the indicators of the accounting period 2018–2020)

Object	Indicators of comprehensive assessment								
	SEnK ₁	SEnK ₂	SEnK ₃	SEnK ₄	SInK ₁	SInK ₂	SInK ₃	SInK ₄	SInK ₅
PJSC “Carlsberg Ukraine”	47.07	0.02	0	141.45	3.5	2.67	0.3	5	0.23
PJSC “Obolon”	31.05	0.26	0	132.5	2.13	2.8	0.28	5	0.33
Odesa Cannery Factory	11.43	0	0.13	78.33	1.8	2.5	0.14	1.07	0.1
PJSC Chernivtsi Bread Plant	13.43	0.2	0.01	58.67	1.07	1.07	0.19	1	0.1
PJSC “YENNY FOODS”	9.36	0	0.13	54.57	1	1.5	0.13	0.9	0.24
PJSC “Odesa Canning Plant for Baby Food”	35.40	0.3	0.02	140	1.93	2.767	0.597	1.133	0.25
PJSC “Odesa Meat Processing Plant”	0.01	2.77	0.02	0.43	0.5	0	0.17	0.1	0.1
PJSC “Reni Meat Processing Plant”	2.831	0.233	0	0.1	1	0.467	0.2	0.067	0.45
$M[X_j]$	18.823	0.472	0.038	75.76	1.616	1.721	0.250	1.783	0.225
σ_j	15.832	0.875	0.053	54.55	0.884	1.047	0.143	1.897	0.117

Note: formed by Authors on the basis of calculations of analytical data of enterprises

Table 5

Analytical study of a multidimensional object (Z_{ij}) of signs for the formation of the integral DSSSD index of small and medium-sized businesses in the food industry (Table of objects is grouped according to the weighted average method, according to the results of calculating the indicators of the period 2018–2020)

Object	Indicators of comprehensive assessment							
	SEcK ₁	SEcK ₂	SEcK ₃	SEcK ₄	SEcK ₅	SEcK ₆	SEcK ₇	SEcK ₈
PJSC “Carlsberg Ukraine”	-0.2567	1.1044	0.3195	0.1803	1.5579	1.8495	-0.7656	0.7241
PJSC “Obolon”	-0.3392	-0.0344	0.7224	0.0000	1.1733	0.8042	-0.6542	0.7241
Odesa Cannery Factory	-0.4852	-1.3630	-0.1281	0.0902	0.0529	-0.6130	-0.6542	-0.3263
PJSC Chernivtsi Bread Plant	0.4224	0.7248	1.3491	2.0738	-0.7832	-0.4613	-1.3224	-0.7979
PJSC “YENNY FOODS”	-0.6185	-0.6987	-1.0235	-0.9918	-0.6160	-0.7695	-0.0974	-0.5835
PJSC “Odesa Canning Plant for Baby Food”	-0.6242	1.6642	-1.1801	-0.9918	0.8388	1.0106	0.4705	2.0602
PJSC “Odesa Meat Processing Plant”	2.5040	-0.9834	1.2148	0.7213	-1.0006	-0.7185	1.5730	-0.8693
PJSC “Reni Meat Processing Plant”	-0.6026	-0.4140	-1.2741	-1.0820	-1.2230	-1.1020	1.4505	-0.9315
Z_{0j}	2.504	1.664	1.2148	0.7213	1.5578	1.8494	1.5729	2.0602

Each coordinate axis displays the calculation of a certain group of factors (Fig. 1).

However, known taxonomic procedures do not involve taking into consideration the varying degrees of influence of various signs on the final “effectiveness” of multidimensional objects. Therefore, further analysis carried out in the STATISTICA 10 software, and the final stage of taxonomic analysis made it possible to identify the possibility

of enterprises entering a certain zone of maturity. If one chooses the scaling of rank and measurement according to the criteria of the matrix of maturity level CSR-digitalization, then in the context of 3D Surface one can see the diffusion distribution of criteria for each enterprise. The area of measurement of maturity of social corporate responsibility is indicated by a red color, the digitalization zone is green (Fig. 2).

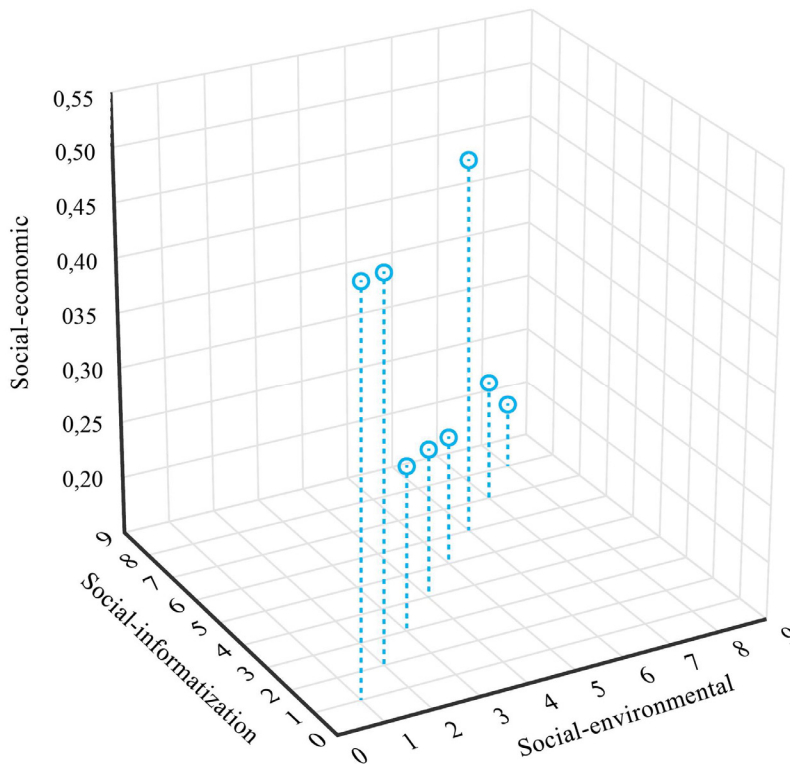


Fig. 1. Plot of the positioning of enterprises according to the DSSSD maturity index for 8 food industry enterprises (STATISTICA 10 listing, 3D Scatterplot tab)

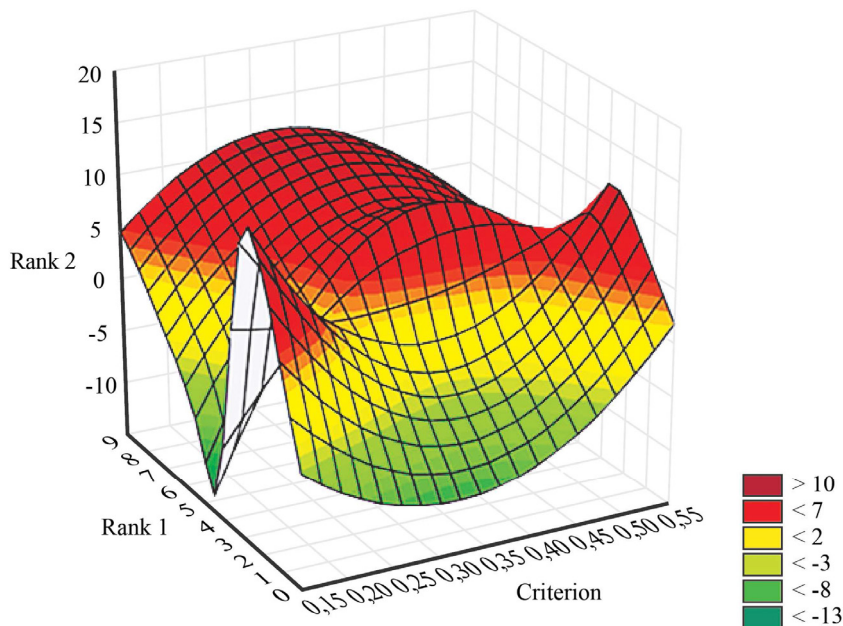


Fig. 2. The surface of enterprises’ response to certain criteria in the zone of “digital space of socially sustainable development” in the coordinate system: socio-economic group; social-environmental group; social-informatization group. (STATISTICA 10 listing, 3D Surface Plot tab)

In the 3D Surface Plot space, it is more clearly seen that inside the DSSSD integral indicator, the estimates are heterogeneous, and this determines the areas of their potential growth and development. As well as identifying potentials for strengthening their own positions (Fig. 2). Each investigated enterprise has its strengths and weaknesses, owing to the analysis of which it is possible to determine which directions in the development strategy should be activated.

In Table 5, the following designations are used:

- C_{i0} – the distance of each point to the development standard Z_0 ;
- Z_0 – the maximum possible value of the development standard;
- d_i^* – the ratio of the distance C_{i0} to the maximum possible value of Z_0 ;
- D_i – the level of development for each enterprise.

Fig. 3 shows the formed rating of enterprises in the zone of digital space of social sustainable development. DSSSD is conventionally divided into five zones (Digital Descriptive, Solutions Analytics Digital, Smart CIS, Digital Manufacture, Digital Ecosystem) in which an enterprise may find itself. Depending on the zone, it is possible to determine the level of maturity as weak, medium, or high (Fig. 3).

Depending on the values that the company received (Table 7), the DSSSD zone and the level of maturity of the digital space of socially sustainable development achieved by the enterprise are determined (Fig. 3).

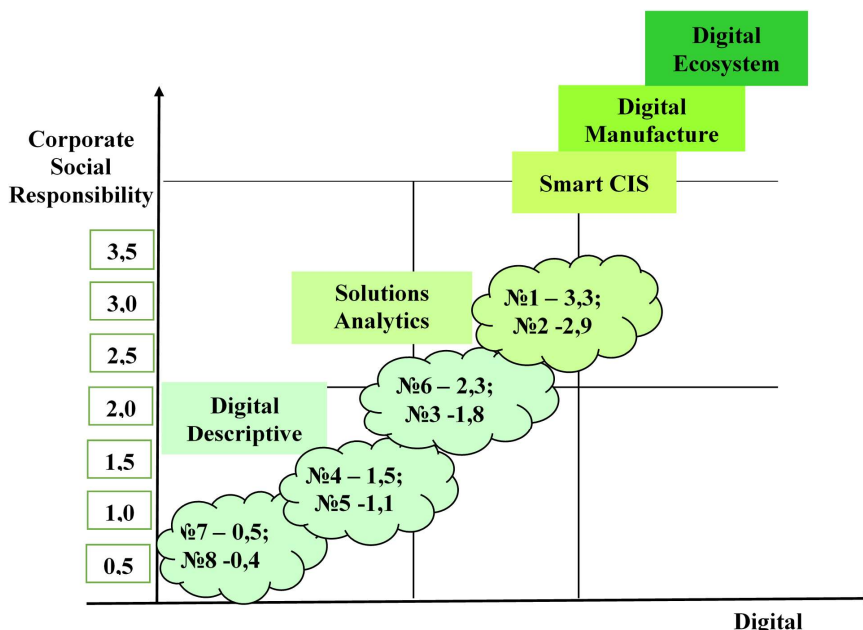


Fig. 3. Distribution of Ukrainian enterprises according to the level of maturity of DSSSD depending on the area of responsibility of the company, in the coordinate system corporate social responsibility/digitalization

Table 6

Analytical study of a multidimensional object (Z_{ij}) of signs for the formation of the integral DSSSD index of small and medium-sized businesses in the food industry (Table of objects is grouped according to the weighted average method, according to the results of calculating the indicators of the period 2018–2020)

No.	No.	Indicators of comprehensive assessment								
		SEnK ₁	SEnK ₂	SEnK ₃	SEnK ₄	SInK ₁	SInK ₂	SInK ₃	SInK ₄	SInK ₅
	PJSC “Carlsberg Ukraine”	1.7841	-0.5171	-0.7277	1.2042	2.1315	0.9055	0.3444	1.6951	0.0428
	PJSC “Obolon”	0.7722	-0.2431	-0.7277	1.0402	0.5813	1.0297	0.2042	1.6951	0.8979
	Odesa Cannery Factory	-0.4670	-0.5399	1.7135	0.0472	0.2079	0.7432	-0.7772	-0.3762	-1.0689
	PJSC Chernivtsi Bread Plant	-0.3407	-0.3116	-0.5399	-0.3132	-0.6181	-0.6224	-0.4267	-0.4131	-1.0689
	PJSC “YENNY FOODS”	-0.5977	-0.5399	1.7135	-0.3884	-0.6973	-0.2118	-0.8473	-0.4658	0.1283
	PJSC “Odesa Canning Plant for Baby Food”	1.0474	-0.1974	-0.3521	1.1776	0.3550	0.9982	2.4263	-0.3430	0.2138
	PJSC “Odesa Meat Processing Plant”	-1.1883	2.6229	-0.3521	-1.3808	-1.2630	-1.6442	-0.5669	-0.8874	-1.0689
	PJSC “Reni Meat Processing Plant”	-1.0101	-0.2739	-0.7277	-1.3868	-0.6973	-1.1982	-0.3566	-0.9048	1.9241
	Z_{0j}	1.7840	2.6228	1.7135	1.2042	2.1314	1.0296	2.4263	1.6951	1.9240

Table 7

Fragment of the final taxonomic analysis of the calculation of the integral indicator D_i of the level of maturity of the indicator «digital space of socially sustainable development» (calculation period 2018–2020)

No.	Indicator of distance from Z_0			Rank	Enterprise name
	C_{i0}	d_i^*	D_i		
1	6.32388	0.488492	0.51151	1	PJSC “Carlsberg Ukraine” No. 1
2	6.58299	0.508508	0.49149	2	Private enterprise “Obolon” No. 2
3	9.10979	0.703692	0.29631	4	“Odesa Cannery Plant” No. 3
4	9.31519	0.719558	0.28044	5	PJSC Chernivtsi Bread Plant No. 4
5	9.53987	0.736914	0.26309	6	PRIVATE LIMITED “YENNY FOODS” No. 5
6	6.62512	0.511762	0.48824	3	PJSC “Odesa Canning Plant for Baby Food” No. 6
7	9.57996	0.74001	0.25999	7	PJSC “Odesa Meat Processing Plant” No. 7
8	10.2552	0.792168	0.20783	8	PJSC “Reni Meat Processing Plant” No. 8

Five areas of maturity of the company are considered, formed according to the requirements of the level of digitalization and the use of CSR standards, which are partially used in international corporations such as Gartner Supply Chain [15]:

- Zone 1 (Digital Descriptive). Fragmented portfolio of technologies employed at the enterprise with a large number of non-automated business processes;
- Zone 2 (Solutions Analytics Digital). Existing information technologies that have separate analytical modules and digital IT but are not integrated into the internal corporate information system (CIS);
- Zone 3 (Smart CIS). Business scaling is due to digital technologies with elements of analytics;
- Zone 4 (Digital Manufacture). Full-featured CIS, in which internal elements are closely connected by IT technologies, and actively use modern capabilities of cloud technologies, Big Data analytics, and neural networks;
- Zone 5 (Digital Ecosystem). The company is fully functional in the digital space. Almost all business processes are carried out in the digital space, there is a mandatory cybersecurity module.

6. Discussion of results of studying the formation of the digital space of socially sustainable development

Systematization of forms and tools for the implementation of CSR, which is given in Table 1, demonstrated the positive impact of CSR on the external and internal environment of enterprises, classified forms and tools for achieving such an impact. This is provided by an integrated approach to analyzing the impact of CSR in the context of digitalization of the economy on the activities of enterprises.

Analysis of estimates of the level of CSR and the problems of their application allowed us to develop proposals for improving the methods of quantitative and qualitative assessment of CSR. We proved the need to take into consideration indicators of different origin: financial, economic, and social. From an economic point of view, the social responsibility of business means achieving commercial success taking into consideration moral and ethical principles, so its definition is proposed to be justified through a system of quantitative and qualitative indicators. Critical comprehension of the proposed assessment methods makes it possible to compare companies and rank them by rating.

The proposed system of indicators for determining the internal level of corporate social responsibility, in contrast to the existing assessment methods, includes a group of social and informatization indicators. These include the level of software, informatization of management procedures; index of digitalization of the enterprise (Table 2).

The advantages of this approach are:

- accounting for the impact of indicators that characterize the digitalization of the enterprise;
- transparent tracking of the level of maturity of the corporate social responsibility information system according to the DSSSD criteria;
- a clear idea of the costs of informatization processes of the enterprise in relation to the positions received.

The developed scientific and methodological approach to determining DSSSD provides an opportunity to determine the ratings of small and medium-sized businesses in the vector direction: digitalization/CSR using taxonomic analysis.

This is clearly demonstrated by the example of eight food industry enterprises (Tables 3–6). Each investigated enterprise has its strengths and weaknesses, owing to the analysis of which the directions in the development strategy that need to be activated are determined.

In the course of the analysis, it was revealed that groups of socio-economic, socio-ecological, and socio-informational indicators of the enterprise may correspond to different levels of CSR development, on the one hand, and informatization and digitalization of the enterprise's activities, on the other hand (Fig. 2). This makes it possible to maximize the positive impact of business on society, to create conditions for sustainable development of enterprises.

We have proposed a zoning characteristic according to the selected quadrants, and according to the definition of CSR development levels and the level of digitalization. The characteristic of five zones of maturity of IC enterprises in the context of digitalization/CSR has been developed (Fig. 3). The proposed distribution is based on the fact that the level of development of information systems of enterprises with signs of CSR depends on the stage of the company's life cycle. This makes it possible to present the development of digitalization through the life cycle curve of IC CSR.

The results of studying the processes of formation of DSSSD provided an opportunity to identify the level of CSR in the information systems of enterprises, and bottlenecks in the implementation of the provisions of socially sustainable development in business architecture.

A feature of the developed evaluation method is that it is necessary to use analytical data not only from open sources and databases but also to collect information within the enterprise.

To conduct a qualitative analysis, it is necessary to investigate the financial activities of each enterprise, provide an expert assessment of non-financial statements, take into consideration the degree of informatization openness of the enterprise (website, reviews of counterparties). In addition, enterprises should be approximately of the same level of development and size. This partially limits the conditions for applying the technique.

However, such a thorough approach will make it possible to effectively investigate the level of CSR at enterprises of one industry and optimize the quality of CSR information systems in food enterprises.

One of the biggest problems in the company's approach to social responsibility is the lack of integration of individual CSR programs into the company's management strategy, as well as the "residual" principle of including socially responsible activities in the main one. This is because the company believes that the problems of society do not affect its activities.

Information systems and IT are a complex of software and hardware and methods of production, transmission, processing, and consumption of information in an integrated enterprise system. The introduction of such a system will contribute to the creation of a digital space in which information flows have measurement indicators for input and output data streams. This will provide an opportunity for automated controlling, analytics, and a combination of financial and economic indicators with high-quality socio-environmental ones.

Some indicators of the impact of CSR on business activities are increasingly used by international companies and

corporations and are gradually becoming classic. Thus, the presented methodology for determining DSSSD (“digital space of social sustainable development”) will be interesting and useful for theoretical and applied research in Europe and the USA.

In further work, it is planned to develop detailed recommendations for strategic maps of enterprises based on IT systems with CSR support, the purpose of such a study will be the ability to determine the current level of DSSSD and the formation of development vectors for the future.

7. Conclusions

1. Determining modern views on the forms and tools of CSR in the context of digitalization of the economy has shown that there is no single approach to the norms and standards for the implementation of CSR in enterprises. Therefore, in this work, the analysis of the definition of CSR was carried out depending on the impact on changes in the external or internal environment. In the process of systematization, key indicators for measuring the internal and external system of corporate social responsibility implementation have been selected and more specifically defined. And despite the fact that there are separate indicators in each country, such a generalization makes it possible to combine them and create an innovative method of their measurability and comparison.

2. Methodological support for determining the level of formation of the internal system of corporate social responsibility was based on the need to take into consideration three areas: socio-economic, socio-environmental, and socio-informatization. New realities of society, digitalization of business processes require improvement of the methodology for assessing the level of CSR, taking into consideration compliance with world standards for the use of safe technologies, the degree of informatization of business processes. The selected indicators made it possible to reflect key points in the activities of the enterprise and not overload the methodology with additional indicators. In addition, it is extremely important for food industry enterprises to focus on the quality and safety of production and goods, which increases their social brand. The introduction of indicators of the informatization group provided an opportunity to assess the level of involvement of IT components in the business architecture of the enterprise

and determine the level of openness and maturity of the company in the digital space.

3. The proposed scientific and methodological approach to determining the level of maturity of the digital space of socially sustainable development of enterprises, based on taxonomic analysis, made it possible to combine and make measurable quantitative and qualitative indicators of activity. The approbation of the methodology made it possible to determine the current state in which each of the 8 enterprises was located according to three groups of criteria and graphically compare enterprises according to criterion criteria. The directions of development improvement for each of the enterprises in the coordinate system of corporate social responsibility/digitalization have been identified.

It is proposed to divide the digital space of social sustainable development (DSSSD) into five zones (Digital Descriptive, Solutions Analytics Digital, Smart CIS, Digital Manufactory, Digital Ecosystem) in which the enterprise may find itself. According to separate criteria, each enterprise may have a higher or lower rate, so the transition from one zone of maturity to another is rather arbitrary. The introduction of CSR coordinates/digitalization makes it possible to determine the desired direction of development of the enterprise in order to achieve a higher level of maturity, to determine the effectiveness of the introduction of innovations in the direction of CSR or digitalization of the enterprise.

The proposed methodology makes it possible, on the one hand, to simplify the process of defining and analyzing such complex definitions as corporate social responsibility and digitalization. On the other hand, it makes it possible to compare qualitative and quantitative indicators and benchmark enterprises with each other.

The proposed approach makes it possible to justify investments in new forms and tools of CSR and KIS of the enterprise, the purchase of dedicated software, to determine the point key effective directions for the development of a particular enterprise.

Conflict of interest

We solemnly declare that we do not have a conflict of interest in relation to this study, including financial, personal, authorship, or of other nature, which could affect the study and its results reported in this paper.

References

1. Apal'kova, V. V. (2015). The concept of the digital economy in the European Union and the prospects of Ukraine. *European Journal of Management Issues*, 23 (4), 9–18. doi: <https://doi.org/10.15421/191502>
2. Chuprina, M., Zhaldak, H. (2020). New trends in the sphere of corporate social responsibility. *Efektivna Ekonomika*, 11. doi: <https://doi.org/10.32702/2307-2105-2020.11.87>
3. Ziolo, M., Bak, I., Filipiak, B. Z., Spoz, A. (2022). In search of a financial model for a sustainable economy. *Technological and Economic Development of Economy*, 28 (4), 920–947. doi: <https://doi.org/10.3846/tede.2022.16632>
4. Bocharova, N., Shchepilina, A. (2017). Indicators of the level of corporate social responsibility development at motor transport enterprises. *Economics of the transport complex*, 30, 85–99. doi: <https://doi.org/10.30977/etk.2225-2304.2017.30.0.85>
5. Camilleri, M. A. (2017). Corporate Citizenship and Social Responsibility Policies in the United States of America. *Sustainability Accounting, Management and Policy Journal*, 8 (1), 77–93 doi: <https://doi.org/10.1108/sampj-05-2016-0023>
6. Jamali, D., Karam, C. (2016). Corporate Social Responsibility in Developing Countries as an Emerging Field of Study. *International Journal of Management Reviews*, 20 (1), 32–61. doi: <https://doi.org/10.1111/ijmr.12112>

7. Martyniuk, O., Vitvitskaya, O., Lagodiienko, V., Krupitsa, I. (2019). Formation of an innovative concept of management on the basis of reconstruction of genetic algorithm of management technology. *Periodicals of Engineering and Natural Sciences (PEN)*, 7 (2), 487. doi: <https://doi.org/10.21533/pen.v7i2.560>
8. Kim, Y., Atukeren, E., Lee, Y. (2022). A New Digital Value Chain Model with PLC in Biopharmaceutical Industry: The Implication for Open Innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 8 (2), 63. doi: <https://doi.org/10.3390/joitmc8020063>
9. The Framework for Enterprise Architecture: Background, Description and Utility by: John A. Zachman. Available at: <https://www.zachman.com/resources/ea-articles-reference/327-the-framework-for-enterprise-architecture-background-description-and-utility-by-john-a-zachman>
10. Zachman, J. A. (1987). A framework for information systems architecture. *IBM Systems Journal*, 26 (3), 276–292. doi: <https://doi.org/10.1147/sj.263.0276>
11. CNews: IT Trends 2020. Available at: <https://www.cnews.ru/reviews/ittrendy2020>
12. The KPMG Survey of Corporate Responsibility Reporting 2013. Available at: <https://assets.kpmg/content/dam/kpmg/pdf/2013/12/corporate-responsibility-reporting-survey-2013.pdf>
13. Senkevich, A., Voit, D. (2020). Digital transformation of territorial management systems: directions and prospects of development. *Black Sea Economic Studies*, 52-2, 81–85. doi: <https://doi.org/10.32843/bses.52-35>
14. Lingur, L. (2020). Integrated approaches of csr information system formation for small and medium business enterprises. *Economy and Society*, 22. doi: <https://doi.org/10.32782/2524-0072/2020-22-38>
15. Lisica, J. (2019). Exploring the Journey to Digital Excellence in Supply Chain. Gartner. Available at: <https://blogs.gartner.com/power-of-the-profession-blog/exploring-journey-digital-excellence-supply-chain/>
16. Pliuta, V. (2012). Porivniannia bahatomirnoho analizu v ekonomichnykh doslidzhenniakh: Metody taksonomiyi i faktornoho analizu. Moscow: Statystyka, 151.
17. Möller, F., Stachon, M., Azkan, C., Schoormann, T., Otto, B. (2021). Designing business model taxonomies – synthesis and guidance from information systems research. *Electronic Markets*, 32 (2), 701–726. doi: <https://doi.org/10.1007/s12525-021-00507-x>
18. Sergiienko, L., Polyak, K., Poverlyak, T., Cherchata, A., Andriushchenkoe, I., Zhyliakova, O. (2020). Application of taxonomic analysis in assessing the level of enterprise development in emergency situations. *Management Science Letters*, 1329–1340. doi: <https://doi.org/10.5267/j.msl.2019.11.024>
19. Kaczmarczyk, P. (2017). Taxonomic Analysis of Voivodships Development in Terms of ICT Usage in Enterprises. *Folia Oeconomica Stetinensia*, 17 (2), 83–96. doi: <https://doi.org/10.1515/fofi-2017-0020>