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## IMPLEMENTATION OF CORPORATE SOCIAL RESPONSIBILITY IN THE CONTEXT OF INTEGRATION WITH THE ENTERPRISE MANAGEMENT INFORMATION SYSTEM

**Purpose.** To develop recommendations for the corporate digital responsibility (CDR) strategy aimed at increasing the level of integration of corporate social responsibility (CSR) and information systems (IS) of the company. To develop a mathematical model of coordination decisions regarding CSR with production and business activities of companies.

**Methodology.** The introduction of the methods of: logical generalization made it possible to define CDR adapted to Ukrainian realities; analysis and synthesis – to point out the need to integrate CSR with IS; comparative analysis – to determine directions, tasks, requirements for the implementation of CDR; logical abstraction – to substantiate the need to implement strategy for CDR implementation, develop its stages, tasks and goals of each stage; mathematical analysis – to develop mathematical model of coordination of management decisions.

**Findings.** A definition of CDR, adapted to Ukrainian reality, which became the conceptual basis of the presented research, is proposed. The need for integration of CSR and IS and the formation of a new mechanism – CDR, as a result of the evolution of CSR, is substantiated. The directions, tasks, and requirements for the implementation of CDR are defined. The need to implement the strategy for the implementation of CDR are substantiated, its stages, tasks and goals of each stage are developed. It is indicated that the integration of CSR and IS can take place iteratively, with management gaining experience and finding optimal methods and tools.

**Originality.** A mathematical model that allows one not only to coordinate various management decisions, but also to forecast their short-term and long-term results, is developed.

**Practical value.** The proposed approach to CDR strategy formation will increase the effectiveness of CDR and improve the integration of CSR and IS. The developed mathematical model will allow one not only to solve the problem of coordination of management decisions, but will also help to economically spend IT resources and speed up the delivery of results.

**Keywords:** *management, corporate social responsibility, information systems, mathematical model*

**Introduction.** Ukrainian companies permanently operate at extremely unstable rates of inflation, in changing economic, political and social realities. This increases the requirements for their management, the leadership qualities of managers, and creates the need for an increase in the level of internal integration of companies and enterprises. The conditions of military operations significantly increase the need to use all potential opportunities to ensure the stability of production and business activities of enterprises while simultaneously increasing the level of flexibility to external challenges. This is also possible with the effective use of the mechanism of corporate social responsibility. Ensuring corporate social responsibility is of particular importance in wartime conditions. As a result of systematic rocket and bomb attacks, not only the infrastructure of enterprises suffers, the threat of attacks also psychologically destabilizes employees. An increase in the level of psychological health ensures the stability of the enterprise's work, and the growth of the level of internal integration of companies. In such conditions, corporate social responsibility becomes an effective tool for uniting the team, increasing the concentration of employees on solving production problems.

Nowadays the scale and comprehensiveness of challenges and threats exclude the traditional approach of solving the problems of corporate social responsibility and management of the enterprise's production activities separately, because this can lead to a decrease in the level of efficiency of the company's functioning and even paralyze it. Solving such a task is difficult without supporting tools, even for small companies.

This determines the use of the latest information technologies to increase the effectiveness of management activities in this area. Since the implementation of corporate social re-

sponsibility (CSR) affects all areas of the company's activity, this indicates the feasibility of CSR integrating and digital technologies and the formation of a new mechanism called corporate digital responsibility (CDR). It is the integration of the indicated directions that is able to realize a synergistic effect, which can ensure the proper efficiency of management activities and the adaptability of the enterprise to the conditions of significant instability of the external environment.

**Literature review.** Many scientific works are devoted to corporate social responsibility. Thus, in her study, Matrosova [1] indicates that the implementation of corporate social responsibility for its conceptual interpretation should be carried out at the expense of "increasing the level of relationship between trust in the brand and the social responsibility of companies in society", which will contribute to "further development of domestic companies, improving their activities, increasing the value of intangible assets".

Zozulaková and others [2] stated that "corporate social responsibility is a business approach that helps a company to be socially responsible to society and, first of all, to itself and its stakeholders". It is also indicated that the effectiveness of digital CSR strategies should consist in "identifying opportunities for the greatest impact on business" [2]. Hanelt and others [3] provided a thorough systematic review of literary sources where the authors investigated the consequences of digital transformation for the implementation of organizational changes, primarily for the use of ideas of corporate social responsibility. Atanaso, et al. [4] carried out a systematic review of literary sources regarding the conditions, forms, and aspects of the implementation of digital technologies in all spheres of corporate social responsibility. Unfortunately, the process of integration of information systems and the mechanism of corporate social responsibility remained out of the consideration of

Atanasov, et al. [4]. Hakimi and others [5] together with the study on the activities of EU companies pointed out the non-linearity of the relationship between corporate social responsibility and the efficiency of the firm. Two main factors are highlighted: an increase in the number of EU companies included in the mechanism of corporate social responsibility, provided that the return on assets exceeds the threshold of 1.231 %, and the acquisition of a greater influence of environmental protection measures on the corporation's activities as a result of the implementation of EU incentives and sanctions regarding environment pollution. If the first factor is mainly of reputational importance, then the second one takes into account the level of external risks for business activity, which is of paramount importance for Ukrainian companies. This is considered in the presented article. Fenech, et al. [6] studied the issue of corporate social responsibility for the digital transformation of companies in view of the need to constantly improve the quality of the company's human capital in order to match the level of digital literacy of the staff to the digital tools implemented or being prepared for implementation by the company. The presented research considers the need for such compliance.

Vasylytsiv [7] researched directions for stimulating social responsibility of Ukrainian enterprises and indicated the need for a comprehensive approach to managing its "formation, development and effective use". The general direction defined by Vasylytsiv [7] is developed in the presented study. Yevstakhevykh [8] pointed to "the connection between social responsibility, efficiency and transparency". A study on the implementation of CSR methods in the practice of large Ukrainian companies indicated insufficient transparency of this process and an insufficient level of use of information and communication tools to facilitate this process [8]. Mihale-Wilson, et al. [9] examines the conceptual issues of corporate digital responsibility (CDR) and corporate social responsibility (Corporate Social Responsibility – CSR). In particular, it is argued that the conceptual difference between CDR and CSR is defined only by the fact that the latter has a broader social purpose, while the former "centers around technology". This, according to Mihale-Wilson, et al. [9], leads to a difference in goals: CSR should "focus on strategic and managerial tasks", CDR should focus on "the best digital practices". It is controversial since digitalization can be not only the goal of the enterprise, but also a necessary tool for achieving goals, both corporate and social. At the same time, the statement of Mihale-Wilson, et al. [9] that the implementation of CDR needs considerable attention from researchers both from a conceptual and a practical point of view is correct, which is considered in the presented study. Mueller [10] suggests a leadership, centralized view of CDR, where "an appropriate office or company official is given the authority and resources to oversee and enforce CDR". This makes sense given the high dynamism of risks, which requires the dynamism of making and implementing complex decisions, in particular, decisions in the field of CDR. This is tangentially confirmed by Elliott, et al. [11], where it is proposed to consider the automated decision-making system as a "black box", due to the significant complexity of the effects of factors on CDR problems. At the same time, van der Aalst, et al. [12] indicated that the perception of CDR support information systems as "black boxes" can be perceived as unfair and unethical. These theses are considered in the presented study. De Ruiter, et al. [13] highlight the importance of compliance with the principle of corporate policy ethics, in particular the ethics of leadership, in much more detail. Ethical leadership contributes to strengthening the trust of the company's employees in the leader, which is of particular importance in the period of increased risk [13]. De Ruiter, et al. [13] also indicate that ethical leadership will have not only an indirect, but also a direct effect on the effectiveness of corporate social responsibility.

The question of the importance of the manager's leadership qualities for the introduction of organizational changes in a period of crisis is indeed important, but gaining trust in the

team will rely exclusively on trust in the leader only for rigid hierarchical structures. To increase trust in the team, and, accordingly, to increase the effectiveness of corporate social responsibility, other tools can be used, in particular, digital ones, which is considered in the presented research.

The given review of literary sources points to many aspects of CSR implementation, in particular, the use of digital tools. At the same time, the indicated review shows significant differences of opinion among scientists even in defining the purpose and tasks of the CDR. The question of the value of CDR for solving tactical tasks of neutralizing risks to corporate activity in the face of significant dynamism of external threats, which is a significant factor in using the CSR mechanism for the sustainability of Ukrainian enterprises, is also insufficiently studied. The issue of the need not only to use digital technologies to increase the effectiveness of CSR, but also their integration and development into a new form – CDR, has not been sufficiently studied.

**Purpose.** To develop recommendations for the implementation of the strategy of corporate digital responsibility aimed at increasing the level of integration of corporate social responsibility and the company's information systems. To develop a mathematical model of coordination of decisions regarding corporate social responsibility and production and business activities of companies.

**Methods.** In the research, the results of which are presented in this article, general and special methods of cognition were used.

The application of the method of logical generalization made it possible to propose a definition of CDR adapted to Ukrainian realities, which became the conceptual basis of the presented study. The introduction of the method of analysis and synthesis made it possible to indicate the need for the integration of CSR with information systems of the enterprise and the process of their evolution to CDR. The method of comparative analysis made it possible to determine the directions of implementation of social responsibility in Ukraine, to establish tasks, circumstances that will affect the effectiveness of the implementation of CDR, and to establish requirements for the team, management of the enterprise and the project of the information system for supporting CDR.

The method of logical abstraction made it possible to substantiate the need to implement an appropriate strategy aimed at increasing the level of integration of CSR and information systems of the company, to develop its stages, to detail the tasks and goals of each of the stages. The methods of mathematical analysis, in particular, the method of gradient analysis and the method of ordering heterogeneous sequences of factor influences, allowed the development of a mathematical model for the coordination of various management decisions.

**Results.** The generally accepted definition of corporate social responsibility is "the fulfillment of the company's obligations to stakeholders. In fulfilling these obligations, it is necessary to minimize damage, and to maximize the long-term positive impact of the company on society" [10]. The mentioned article also specifies the tasks of corporate social responsibility – "working conditions, human rights and social justice". This can be interpreted quite broadly – from internal corporate issues to society on a national and, even, global scale (for example, socially significant activities of corporations in reducing the greenhouse effect). An example of a too broad interpretation of the concept of CDR is the definition of CDR "as a set of common values and norms that guide the organization's activities" [14].

Conceptual approaches proposed by researchers from countries with more stable economies largely contrast with the modern realities of Ukrainian business, which operates under conditions of significant dynamic risks. If the general conceptual approaches of researchers of countries with a sustainable economy propose to focus on the "rules and norms" that corporations must adhere to in order to ensure their significance

for society [15], to “create a more sustainable and socially responsible business” [16], when implementing CDR, the Ukrainian business should use CDR first of all as a means of increasing the viability of the enterprise and the country. This view differs even from studies that record “the relationship between managerial strengthening, social responsibility and the risk of the firm’s activity” [17], since the mentioned studies, in particular, Salehi, et al. [17] refer only to market risks. It is also necessary to take into account Carroll’s well-known “CSR pyramid”, which details the significant areas of CSR. Therefore, in the presented study, the definition of CDR is proposed, which consists in “facilitating the fulfillment of a full set of company obligations, including social, economic, and discretionary, to effectively ensure the sustainability of the operation and competitiveness of the enterprise by integrating the CSR mechanism and digital technologies. Fulfilling these obligations, it is necessary to minimize risks for the company and society”.

Conceptually, CDR should also promote effective relationships between employees and digital technologies to increase sustainability at both the corporate and societal levels.

From the point of view of designing information systems for the implementation of CSR tasks, corporate transparency must be implemented at all levels – digital technologies, algorithms, data flows, decision-making with unconditional observance of the principles of personal information confidentiality and cyber security. The ethical and legal level of CSR should also be ensured. Corporate leaders must make decisions based on digital tools and adhere to the values of society. There should be no contradictions between the values of the team, manager (leader) and society. The flexibility of decision-making algorithms of autonomous digital systems should not lead to value conflicts.

The appropriate level of use of the potential opportunities of corporate culture, the effectiveness of the implementation of the mechanism of corporate social responsibility are conditioned not only by the support of management decisions by information technologies, but by consistent, permanent, systematic coordination of each management task with the integrated information system of the enterprise and, in general, with each of its subsystems. First of all: with the decision-making preparation system, with support systems for each of the production or management activities, with the information and communication system of the enterprise. This determines the need for the integration of CSR and information technologies and the formation of a new mechanism – CDR, as a result of the evolution of CSR and information systems, since it is the integrated information system of the enterprise that in the most effective way will allow to ensure the main directions of the implementation of corporate social responsibility: “formation of organizational procedures” [18], “combining organizational capabilities into a single entity” [19], “providing solutions to problems” faced by the organization [20, 21], and, as a result, “impeding or facilitating the organization’s achievement of its goals” [4, 22]. In this way, digital tools allow the immanent “socially complex” and “causally ambiguous nature” of corporate social responsibility to be transformed into sustainable company performance that provides competitive advantages in the market.

The stimulating effect of the introduction of CDR to self-organization should be implemented to strengthen the internal integration of the company and achieve a higher level of coordination of the activities of both individual employees and structural divisions. All of the above should increase flexibility and adaptability to external challenges [23]. This will be facilitated by the synergy of the combination of “top-down” management actions with “bottom-up” control actions, which should be provided by information technology.

The complexity of the effective implementation of CDR, even in countries with a stable economy, lies in the different orientation of the vectors of the main tasks of CDR: the pri-

mary provision of economic or social goals; formation of transparency of the company’s activities, managerial actions of its management against the need to ensure confidentiality; achievement of corporate interests while ensuring proper working conditions of the corporation’s employees and the interests of society; the right of the manager to make a decision and to ensure the confidence of the team in this decision [24, 25].

In view of the above, Ukrainian realities necessitate the introduction of the following areas of social responsibility implementation at the internal corporate level:

1. Professional development of the company’s employees (in particular: formation of conditions for employees to acquire new professional knowledge and/or skills; introduction of incentives to increase the quality of performance of work tasks and thus, formation of employee awareness of their professional development; introduction of human capital development plans).

2. Social security (in particular: ensuring proper living and working conditions for the company’s staff through the provision of a package of social services, implementation of health care measures, provision of social benefits, etc.).

3. Material support of employees (in particular: relying not on the mechanism of wage rates, but on financial incentive tools depending on productivity and quality of work).

4. Stimulation of labor efficiency (in particular: optimization of economic activity; introduction of proper work regimes and rest conditions; effective personnel management, etc.).

5. Stability of personnel potential (in particular: optimization of the use of personnel potential, effective maneuvering of personnel in the event of a sudden shortage of employees due to external challenges: mobilization, use of employees to overcome the consequences of military operations, etc.).

6. Provision of personnel of the appropriate professional level and formation of an effective structure of personnel potential.

The effective implementation of these directions imposes the following requirements on the team, the management of the enterprise and the project of the information system for supporting the CDR:

- compatibility of the team, management of the enterprise and the information system project;

- taking into account the digital impact on the team, enterprise management and society, socially compatible digitalization, using the effect of “digital cohesion” in the enterprise team and society;

- responsibility for the relevance of primary data that is delivered to the information system;

- observance of the right to ownership of information;

- digital mutual control;

- compliance with ethical norms of digital control and digital surveillance;

- compliance with the principles of transparency, data security, avoidance of digital pollution.

But the consequence of this is the digital expansion of the corporation’s capabilities to implement sustainable development in conditions of significant dynamic changes in external influencing factors. Thus, the specified requirements stimulate the process of integration of CSR and the information system of the enterprise.

This integration will allow the following tasks to be performed in real time:

1. Dynamic assessment of the need for the implementation of specific areas of CSR and available resources for this.

2. Management of resources in order to acquire their sufficient quantity in the required period of time.

3. Analysis of the effectiveness of motivational incentives and assessment of the degree of staff readiness for possible short-term interruptions in their provision due to the action of external influencing factors.

4. Assessing the need to introduce information and communication tools, choosing their set and determining its level

of sufficiency to maintain the appropriate level of trust in management actions.

5. Ensuring proper protection of third-party information resources acquired in the course of economic activity, in particular customer data, which will not only increase the trust of stakeholders, prove the level of social responsibility of the enterprise, but will also lead to an increase in the competitive position on the market.

6. Introduction of digital tools, in particular, artificial intelligence, to analyze the behavior of consumers, counterparties and competitors in the market for the development of CSR activities (emotional nature, balance of interests, etc.) that will strengthen the social significance and/or market position of the enterprise.

7. Monitoring the effectiveness of implementing CSR mechanisms, preparing and proposing management solutions for their adaptation to changes in external and internal challenges.

8. Analysis of changes in the external social environment followed by an assessment of the necessary resources to neutralize the effects of potential threats to the company's activities, coordination of resource expenditures for these activities with their needs for internal corporate CSR activities.

The following circumstances will affect the effectiveness of the introduction of CDR:

1. Significant differentiation of operating conditions of Ukrainian enterprises according to regions, industries, set of external threats, dynamism, direction and strength of their influence.

2. The need for additional resources for CDR measures in case of lack of working capital, as a result of market deformation, a decrease in the discipline of meeting financial obligations by counterparties, etc.; lack of personnel resources due to personnel mobilization, migration factors, relocation of enterprises, etc.

3. The possibility not to acquire, but to lose competitiveness due to additional ineffective spending of resources on CSR measures, which is reflected accordingly in the cost price of the company's products or services.

4. Absence of an established practice of implementing CDR in Ukrainian business; the lack of unity of scientists regarding the Ukrainian model of CDR and, as a result, the lack of unified models of CDR management; insufficient understanding by the management and owners of enterprises of the benefits of the introduction of CDR; insufficiency of institutional incentives for the implementation of CDR. The above mentioned in general hinders the choice of the optimal concept of the CDR and the choice of the optimal set of measures for its implementation.

5. The complexity of the economic, political, and social situation in the country, which determines a significant number of factors influencing the company's activities, a result of which is the complexity of algorithmic solutions of information systems of CDR.

6. Uncertainty of norms and rules of internal and external reporting on social responsibility measures of the enterprise.

7. Inadequate development of the company's communication system for disseminating information on CSR measures, spent resources, and results.

8. Uncertainty of communication models of management with the team, with stakeholders to acquire the necessary level of transparency of management actions and the level of trust of the team in the specified actions.

9. Inconstancy of the practice of balancing the interests of interested parties, which leads to the uncertainty of the management regarding the algorithms of information systems for supporting CDR, one of the main principles of which is the acquisition of the indicated balances for the realization of sustainability in the company's activities and sustainability in society.

System management of social responsibility requires:

1. Formation of CDR strategy based on a comprehensive analysis of benefits and costs, assessment of challenges, opportunities for the enterprise and obstacles to implementation, necessary organizational measures.

2. Development of the technical task project for the system of digital support of the Center for Social Security.

3. Introduction of information collection system (in particular, non-financial reports) and providing access to it.

4. Formation of a system of motivating factors.

5. Formation of mechanisms for evaluating the results of the implementation of social responsibility measures.

In view of the above and since CSR measures have long-term consequences, the introduction of the social responsibility mechanism requires the development and implementation of an appropriate strategy (Table 1). The absence of a CSR strategy leads to significant risks, in particular, non-targeted, inefficient use of resources, primarily financial resources, the possibility of abuse, not implementation but only imitation of social responsibility measures and, as a result, loss of trust, irrelevant evaluation of the results of CSR measures. One of the advantages of long-term strategic planning of CDR, with the use of modern information technologies by the management of enterprises in the implementation of methods of corporate social responsibility, is the possibility of step-by-step implementation of the strategy – in separate directions or, even, measures, with the subsequent verification of the acquired results. At the same time, the role of information support in providing a permanent analysis of the specified activity and digital support for CSR decision-making is important. That is, the process of integrating CSR and digital systems of the enterprise under the developed strategy formation approach can take place in an iterative way, with management gaining experience in this area, finding optimal methods and, at the same time, improving algorithms, in particular, algorithms of the management decision support system for CSR activities.

Strategic planning for the implementation of CDR should also take into account the possibility of changing the regulatory framework in this matter. So far, the legal framework is limited to a few legal acts, in particular, the SA8000 standard. According to which, in particular, it is necessary to take into account the provisions on increasing the effectiveness of collective agreements, obtaining a balance of stakeholders' interests, introducing collective agreement with the management of working conditions and basic social measures, etc.

The implementation of the strategy of integrating corporate social responsibility with the company's digital systems also requires, by extension of the aforementioned Mueller thesis [10], the need for a leadership, centralized view of CSR. For this purpose, it is proposed (Table 1) to appoint a person responsible for the implementation of the CSR and social responsibility management and to evaluate his/her leadership qualities.

The specified strategy should take into account the need to implement the tasks of not only functional management, but also other management schemes that can be used by the company: situational, project management, system control and management. The need to forecast external influences on the planning and implementation of CSR measures, the use of tools of direct management influence (orders and instructions) and indirect management influence (in particular, communication and information tools) during the implementation of CSR should also be taken into account.

Also, social responsibility requires the expansion of controlling tools. Controlling "from top to bottom" should be supplemented by horizontal controlling and a significant strengthening of interactive means of communication of the company's management with the team and strengthening of tools for providing information to personnel about the company's activities and management decisions, first of all, regarding the introduction of motivation tools and disciplinary measures, with the introduction of "bottom-up" information feedback.

Stages of CDR strategy implementation aimed at increasing CSR effectiveness and integration of corporate social responsibility and company information systems

No	The name of the stage	Tasks and goals of the stage
1	Objective evaluation of the concept, methods and probable results of the implementation of CDR	<ol style="list-style-type: none"> <li>1. To determine the extent to which CDR strategy corresponds to the organizational culture of the enterprise and its strategic plans.</li> <li>2. To analyze the current state of the company, assess probable external threats and their impact on the company's activities, determine the consistency of these factors with the company's current business processes.</li> <li>3. To determine the level of necessity of CDR from the point of view of the reorganization associated with it.</li> <li>4. To determine the potential benefits of CDR and threats due to the non-implementation of CDR.</li> <li>5. To determine the importance of CDR in the context of the enterprise's industry affiliation and gaining competitiveness in local and global markets</li> </ol>
2	Developing a view of the mission of the enterprise from the point of view of digital social responsibility	<ol style="list-style-type: none"> <li>1. Forecasting the areas of digital responsibility (in particular, regarding data retention of third parties and organizations, use of unlicensed software, etc.).</li> <li>2. Forecasting the directions of expansion of the range of stakeholders, their interests and means of their involvement.</li> <li>3. Forecasting the expansion of opportunities to increase the information and communication impact on society, the expansion of the client base, the increase in the effectiveness of communication and interaction with clients and counterparties using the capabilities of artificial intelligence</li> </ol>
3	Identifying obstacles to the implementation of CDR and ways to overcome them	<ol style="list-style-type: none"> <li>1. To identify discrepancies between the current and desired state of information support.</li> <li>2. To appoint a person responsible for the implementation of CDR and social responsibility management and evaluate his/her leadership qualities.</li> <li>3. To identify the needs to ensure the company's tactical and strategic goals in the following directions: <ul style="list-style-type: none"> <li>- the need to replace software and hardware;</li> <li>- compliance of all digital means with regulatory and legal norms, in particular, ISO norms;</li> <li>- to determine ways to overcome limitations regarding the possibilities of introducing digital tools (cloud technologies, AI, etc.) and regarding the implementation of technical tasks, software algorithms;</li> <li>- to determine the necessary data protection measures;</li> <li>- to determine the need for staff retraining on cyber protection measures;</li> <li>- to notify all stakeholders about the conditions and rules for the implementation of CDR</li> </ul> </li> </ol>
4	Joint inspection by the owners, management and staff of the company of the quality of the removal of obstacles to the implementation of CDR strategy	<ol style="list-style-type: none"> <li>Additional assessment of risks, costs and benefits of CSR to increase management and team; awareness of the details and peculiarities of CDR implementation.</li> <li>2. To ensure that all risks are identified and controlled.</li> <li>3. To assess the appointment of implementation managers and the adequacy of their functions for social responsibility management.</li> <li>4. To evaluate the instrumental, programmatic and organizational measures of providing objective reports on the process of implementation of CDR.</li> <li>5. To assess the adequacy of ensuring the principles of transparency and completeness of providing information to stakeholders</li> </ol>
5	Developing a plan for the implementation of the strategy, which should ensure an unbiased view of the elimination of shortcomings and possible risks	<ol style="list-style-type: none"> <li>1. To ensure adequate organizational and resource potential for the implementation of CDR.</li> <li>2. To determine the optimal terms of organizational, communication and other changes for the implementation of CSR.</li> <li>3. To ensure the conviction of the owners and managers of the company in the appropriate number of tools for informing them about the details and the current state of the implementation of CDR.</li> <li>4. To ensure an impartial view of the elimination of shortcomings, the acquisition of advantages and the opportunity to once again evaluate the company's turnaround to the application of CSR.</li> <li>5. To ensure an increase in the understanding of company owners and managers of the level of responsibility for decision-making regarding CDR</li> </ol>

The integration of corporate social responsibility with the company's digital systems, first of all, with the management decision-making support system, requires the implementation of appropriate algorithms. The problem is that decisions to support social responsibility measures often do not coincide, in particular in terms of resource provision, with decisions aimed at solving problems in the company's core activities, and sometimes contradict them.

The traditional approach to the formation of optimal management actions by the decision-making support system consists in ensuring the planned result by minimizing the total cost of resources for this or minimizing risks. Implementation of corporate social responsibility tasks will require additional resources and such algorithms will reject these solutions. Therefore, the integration of corporate social responsibility with the company's digital systems requires the development of a mathematical apparatus for coordinating decisions. Also, in this case, it is necessary to take into account not only tactical successes in the implementation of management decisions,

but also their strategic consequences. Decisions aimed at taking into account the goals of corporate social responsibility and the main activity of the enterprise can lead to both a synergistic effect and have negative consequences for the formation of the so-called "interference minimum" of management actions. This problem can be interpreted as a problem of forecasting the integral impact of management decisions. Mathematically, this can be represented as a search for such an area  $Q$  in the space of states where the deviations of the gradients of the consequences of management actions in time according to the selected objective functions have acceptable (given by management) discrepancies

$$y_{opt} \in \bar{y} \quad \text{with} \quad \text{grad } y_{opt} \bigcap_{t=t_1+\Delta t}^{\Delta \text{grad } \bar{y} \rightarrow \text{min}} \in Q,$$

where  $y_{opt}$  is the result of an optimal integrated management action that solves the entire set of problems – both corporate social responsibility and the company's main activity;  $\bar{y}$  is a set of consequences of options for management actions, ac-

ording to individual objective functions;  $t$  is the time;  $t_1$  is the initial time value;  $\Delta t$  is a given time interval.

Forecasting the tactical and strategic consequences of management decisions is possible with changes in the value of  $\Delta t$  is a given time interval and the levels of acceptable discrepancies set by management, since long-term forecasts are performed with an increase in the level of uncertainty of the set of influences, in particular, due to a change in the set of influence factors, their significance and, even, direction of action. The problem here is that management often does not know the mechanisms of action of all factors influencing local objective functions. Therefore, a method for organizing heterogeneous sequences of the effects of factors at the input and output of the so-called “black box”, which is a mechanism for forming the local objective function is proposed. As it is known, according to the specified method, at the first stage, the input sequences of influences ( $\vec{b}$ ) are analyzed, and at the second stage, the output sequences of influences ( $\vec{a}$ ) are analyzed

$$(\vec{a} \rightarrow \vec{b}) : \{a_i \rightarrow b_j\}, \quad i = 1, 2, 3, \dots, n; \quad j = 1, 2, 3, \dots, m,$$

where  $i, j$  are the indices of input and output sequences;  $n, m$  are the number of the specified sequences.

If some sequence at the input of the “black box”  $a_1$  determines the sequence at the output  $\beta_1$ , then the connection of these sequences is denoted by  $a_1\beta_1$ . The research by the information system of the entire set of connections  $\vec{a}\vec{b}$  allows their ranking according to the power of influence, which at the next stage allows limiting the range of connections for the next analysis and forecast.

The developed mathematical model was applied for the purpose of coordinating management decisions taking into ac-

count CSR tasks for a number of enterprises, in particular for Ukrnafta-postach LLC. The group of objective functions according to the chosen strategy of the LLC is indicated in Table 2. These are, in particular: strengthening of economic potential; expansion of areas of activity; access to foreign markets, short-term and long-term liabilities, maintaining current liquidity above the regulatory limit (1.5), maintaining the level of profitability of assets higher than the level of inflation, increasing the indicator of gross profitability, and CSR financing. The interconnectedness of the specified objective functions forms input-output sequences (Table 2) and determines their weight. In particular, the connection between the sequence of CSR financing and access to foreign markets is determined by the value of the reputation factor. At the same time, the connection of the sequence of CSR funding with management decisions regarding other objective functions is caused, in particular, by the need for a coordinated distribution of financial resources. The input ( $a_i$ ) – output ( $b_j$ ) factors of the sequences change according to indices depending on the direction of influence. The impact weight ranges from 0 to 1. In this case, the initial factors of sequences are interpreted as the consequences of management decisions. The specified time interval is a month.

Since the agreement of goals is a compromise task, therefore, with limited resources, the success of achieving some of them required giving up others. Therefore, in 2020, the indicator of financial autonomy was only  $\sim -0.12$ , and the level of profitability of assets was lower than the level of inflation, which resulted in the depreciation of the value of assets. At the same time, the proposed approach of dynamic maneuvering with their own and engaged resources allowed the LLC to even increase the level of CSR financing in 2020. In particular, for this purpose, LLC, in

Table 2

Coordination of management decisions taking into account CSR tasks for “Ukrnafta-postach” LLC

Index $i$	Management decisions	Indicator	A given discrepancy, %	Input-output sequences ( $a_i b_j$ )	Impact weight	Achieved value (2019 to 2020), %
1	Strengthening of economic potential	Increase in the amount of assets	0.5	$a_1 b_2$ $a_1 b_4$ $a_1 b_6$ $a_1 b_7$ $a_1 b_9$	0.1 0.4 0.2 0.35 0.15	+18.67
2	Expansion of areas of activity	Growth of current assets	0.04	$a_2 b_4$ $a_2 b_5$ $a_2 b_6$ $a_2 b_7$ $a_2 b_9$	0.15 0.3 0.2 0.35 0.15	+9.59
3	Access to foreign markets	The volume of sales in the specified markets	0.2	$a_3 b_4$ $a_3 b_5$ $a_3 b_6$ $a_3 b_7$ $a_3 b_9$	0.1 0.4 0.2 0.35 0.4	+8.21
4	Maintaining current liquidity above the regulatory limit	Value of current liquidity	0.1	$a_4 b_1$ $a_4 b_6$ $a_4 b_7$ $a_4 b_9$	0.4 0.2 0.4 0.4	$0.21 \ll 1.5$
5	Increase in net income from sales	Increase in net income from sales	1.8	$a_5 b_6$ $a_5 b_7$ $a_5 b_9$	0.2 0.3 0.4	+35.59
6	Reduction of long-term liabilities	Changes in the amount of liabilities	2.5	$a_6 b_7$ $a_6 b_9$	0.2 0.3	-33.33
7	Increase in short-term liabilities	Changes in the amount of liabilities	1.1	$a_7 b_6$ $a_7 b_9$	0.2 0.3	$+34.36 \leq 35$
8	Profitability of sales	Change in EBIT indicator	0.1	$a_8 b_6$ $a_8 b_7$ $a_8 b_9$	0.2 0.3 0.4	-11.9
9	CSR financing	Change in the amount of CSR spending	11.5	$a_9 b_3$	0.4	+74

particular, was forced to increase the annual volume of short-term liabilities almost to the threshold value of 35 %.

This indicates that the proposed mathematical model will allow one not only to solve the problem of harmonizing various management decisions, but also to spend the resources of the information system in an economical way and to speed up the delivery of results.

**Conclusions.** A definition of CDR, adapted to Ukrainian realities, was proposed, which became the conceptual basis of the presented research. It is indicated that the proper level of use of potential opportunities, the effectiveness of the implementation of the mechanism of corporate social responsibility are conditioned not only by the support of management decisions by information technologies, but by the consistent, permanent, systematic coordination of each management task with the integrated information system of the enterprise and, in general, with each of its subsystems. First of all: with the decision-making preparation system, with support systems for each of the production or management activities, with the information and communication system of the enterprise. This determines the need for the integration of CSR and information technologies and the formation of a new mechanism – CDR, as a result of the evolution of CSR and information systems, since it is the integrated information system of the enterprise that will allow ensuring the main areas of implementation of corporate social responsibility in the most effective way.

The areas of implementation of social responsibility in Ukraine at the internal corporate level are defined and it is indicated that the effective implementation of these areas places requirements on the team, the management of the enterprise and the project of the information system for supporting CDR. It is noted that these requirements stimulate the integration of CSR and the information system of the enterprise.

The range of tasks that the specified integration will allow to be performed in real time is indicated. Circumstances that will affect the effectiveness of the implementation of CDR are determined. It is noted that the process of integrating CSR and digital systems of the enterprise can take place in an iterative manner, with management gaining experience in this area, finding optimal methods and, at the same time, improving algorithms, in particular, algorithms of the management decision support system for CSR activities.

In view of the above, and since CSR measures have long-term consequences, the introduction of the mechanism of social responsibility requires the development and implementation of an appropriate strategy. The absence of a CSR strategy leads to significant risks, in particular, non-targeted, inefficient use of resources, primarily financial, the possibility of abuse, not implementation but only imitation of social responsibility measures and, as a result, loss of trust, irrelevant evaluation of the results of CSR measures. Therefore, a CSR strategy was developed, aimed at increasing the level of CSR efficiency and integration of corporate social responsibility and information systems of the company's CSR integration, its stages and detailed tasks and goals of each stage are indicated.

It is indicated that one of the advantages of long-term strategic planning of CDR, with the use of modern information technologies by the management of enterprises in the implementation of methods of corporate social responsibility, is the possibility of step-by-step implementation of the strategy - in separate areas or even measures, with the subsequent verification of the acquired results. At the same time, the role of information support in providing a permanent analysis of the specified activity and digital support for CSR decision-making is important. In this way, the process of integrating CSR and digital systems of the enterprise can take place in an iterative way, with management gaining experience in this area, finding optimal methods and, at the same time, improving algorithms, in particular, algorithms of the management decision support system for CSR activities.

It is indicated that the integration of corporate social responsibility with the company's digital systems requires the

development of a mathematical apparatus for harmonizing decisions regarding CSR and the production and business activities of companies. Therefore, a mathematical model was developed that allows one not only to coordinate various management decisions, but also to forecast the short-term results of management decisions and their strategic consequences. The mathematical model uses the method of gradient analysis and the method of ordering heterogeneous sequences of the effects of factors at the input and output of the so-called "black box" which is a mechanism for forming a local objective function. This will allow not only solving the problem of coordinating various management decisions, but also using the resources of the information system in an economical way and to speed up the delivery of results.

Further research will be aimed at developing tools and methods for the practical implementation of the proposed approach and, since CDR is not limited to social responsibility, attention will be paid to other aspects of digital responsibility.

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## Упровадження корпоративної соціальної відповідальності в умовах інтеграції з інформаційною системою управління підприємством

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**Мета.** Розробити рекомендації щодо впровадження стратегії корпоративної цифрової відповідальності (КЦВ), спрямованої на підвищення рівня інтеграції корпоративної соціальної відповідальності (КСВ) і інформаційних систем (ІС) компанії. Розробити математичну модель узгодження рішень щодо КСВ і виробничої та бізнес-діяльності компанії.

**Методика.** Запровадження методів: логічного узгаляння дозволило запропонувати визначення КЦВ, що буде адаптоване до українських реалій; аналізу й синтезу – вказати на необхідність інтеграції КСВ з ІС; порівняльного аналізу – визначити напрями, задачі та вимоги до впровадження КЦВ; логічного абстрагування – обґрунтувати необхідність уведення стратегії реалізації впровадження КЦВ, розробити її етапи, задачі та мету кожного з етапів. Методи математичного аналізу – розробити математичну модель узгодження управлінських рішень.

**Результати.** Запропоновано визначення КЦВ, адаптоване до українських реалій, що стало концептуальною основою представленого дослідження. Обґрунтована необхідність інтеграції КСВ та ІС і формування нового механізму – КЦВ як результату еволюції КСВ. Визначені напрями, задачі, вимоги для впровадження КЦВ. Обґрунтована необхідність упровадження стратегії реалізації КЦВ, розроблені її етапи, задачі та цілі кожного з етапів. Вказано, що інтеграція КСВ та ІС може відбуватися ітераційним чином, із набуванням менеджментом досвіду та знаходженням оптимальних методів та інструментів.

**Наукова новизна.** Розроблена математична модель, що дозволить не тільки узгоджувати різнопланові управлінські рішення, але й прогнозувати їх короткострокові та довгострокові результати.

**Практична значимість.** Запропонований підхід формування стратегії КЦВ збільшить ефективність КСВ і покращить інтеграцію КСВ та ІС. Розроблена математична модель дозволить не тільки вирішити задачу узгодження управлінських рішень, але й допоможе ощадливо витратити ресурси ІС та прискорити отримання результатів.

**Ключові слова:** менеджмент, корпоративна соціальна відповідальність, інформаційні системи, математична модель

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