Indicators of effectiveness in the sustainable development field of construction companies: evidence of Ukraine

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Abstract. The article is devoted to the issue of sustainable development and practical aspects of its implementation in the field of construction. Priority directions in formation of strategy of sustainable development of construction companies are established. The success of the implementation of the established areas of activity depends on the indicators of effectiveness and efficiency in the field of sustainable development and corporate social responsibility and their monitoring systems. The analysis was performed on 100 construction companies in Ukraine. The construction industry illustrated by concentration calculation indexes which allow to quantify the degree of concentration and intensity of competition in construction. Recommendations for the identification of sustainable development criteria for construction companies as for the development of sustainable development programs and further confirmation of sustainable development reports by auditors were identified.

1. Introduction
The economic processes taking place in the world in conjunction with the need for rational use of natural resources have necessitated the transition from a man-made type of economic development to a model of management without harming future generations, i.e. the paradigm of sustainable development. The essence of sustainable development is a process of change in which the use of resources, investment directions, orientation of technological development and institutional changes are in harmony. Sustainable development, as the latest model of socio-economic development, having several vectors (nature, society, production) gives a clear message to businesses - the success and efficiency of organizations is measured not only by financial indicators but also by the degree of their commitment to sustainable development allows to be effective without compromising future development. If previously the preparation of reports on sustainable development was carried out by only a small number of companies, which set themselves the task of reducing the negative impact on the environment, today it has become common practice for most organizations in different countries. Sustainable development remains one of the most important issues of the organization's interaction with shareholders, employees and other stakeholders. Data on the results of work related to social responsibility and corporate governance (Environmental, Social and Governance, ESG) are the subject of analysis in securities transactions. Sustainability reporting is published by 95% of the companies included in the Global 250 list. In addition to the companies on this list, thousands of other organizations around the world issue reports on sustainable development.
At the same time, businesses also focus on the principles and recommendations for sustainable development reporting when preparing their reports. This trend indicates that the modern business world expects leading companies to prepare reports on sustainable development.

2. Literature review

In the scientific literature there are numerous scientific studies on the problems of sustainable development of society at different levels of its organization. The issues of ensuring effective management of sustainable development of construction companies, as well as methodological approaches to ensure the assessment of sustainable development of the company remain insufficiently researched. The above reasons have led to the need and relevance of this study. Businesses are constantly looking for new opportunities to improve their business reputation, efficiency, and disclosure in the field of sustainable development is becoming an important competitive factor, helping to strengthen investor confidence. Sustainable development reporting provides benefits that go beyond the management of financial risks and opportunities of the company, which allows you to do business in accordance with the principles of sustainable development, which allows you to access new sources of funding, increase operations.

The concept of sustainable development is multi-vector. In recent years, many interpretations of the concept of sustainable development have emerged, so scientists are identifying the components of sustainable development. M. White [1] conducted a study of the sustainable development policy of leading international companies working in the field of construction. His research has shown that sustainable development policies vary depending on the size and goals of the company. Energy efficiency and conservation, reduction of greenhouse gas emissions and integration of renewable energy sources into projects are among the common areas of sustainable development policy. This conclusion was reached by the authors. T. Jones et al. [2] found that sustainable development goals differ in different construction companies. Social orientation is crucial in construction corporations operating in the industrial sector and is always emphasized among commercial contractors and commercial design firms. P. Adrien [3] presented the methodology and recommendations to construction companies in implementing sustainable development measures. J. Sarkis et al. [4] presented a decision model and framework for selecting subcontractors and forming a team in an established environment based on a triple outcome approach. In general, the authors focus on improving sustainable development strategies and achieving sustainable development by companies. The role of construction in the development process and its importance to economic growth is discussed by F. Moavenzadeh [5]. The construction industry is “a sector of the economy which, through planning, design, construction, maintenance and repair, and operation, transforms various resources into constructed facilities” [5]. L. Pheng, L. Hou emphasize that there are three levels to define construction within the literature. Firstly, the construction is referred to as an economic activity that involves the entire construction process from producing raw and manufactured building materials and components, and providing professional services such as design and project management, to executing the physical work on site. Secondly, the construction is conceived as an economic activity that focuses only on the last stage of the construction process which is the physical work carried out on the production site. For third, the construction somewhat in between the two above mentioned extremes [6].

L. Ivanchenkova, L. Skliar etc. developed an algorithm for analyzing enterprise innovation, which will provide a reasoned cost estimate and certainly can be applied to construction enterprises [7]. This algorithm is deepened in the work by O. Osadcha, O. Liashenko etc. [8]. The authors also investigate the methodology of financial and economic analysis of innovative activities of enterprises in the conditions of the digital economy. I. Lazaryshyna, L. Dukhnovska [7] monitor the construction development dynamics in Ukraine in recent years and substantiate its impact on the construction enterprises' financial results in general. They conducted research gives reasons to state the significant role of the country macroeconomic environment in the construction enterprises functioning [9]. The scientific article written by D. Kongo [10], is devoted to the research analysis of promising directions.
for improving the work of the sales department of a construction company through the digital transformation of business processes and the implementation of ready-made IT solutions. Author considered the characteristics of the directions of digitalization of the company's commercial sales cycle. There are many advantages which is formed through the use of digital technologies and ready-made IT solutions. The research of E. Vitkova [11] has confirmed that companies of different sizes show different values of financial indicators. The role of audit firms in validating sustainable development reports and providing various satellite development audit services has been disclosed by L. Chyzhevska, N. Semenushina etc [12].

3. Material and Methods

A number of theorists and proponents of sustainable development consider it the most promising ideology of the 21st century and even of the third millennium, which, with deepening scientific validity, will displace all existing worldview ideologies as fragmentary, unable to ensure balanced development. Objectively, the question arises about the possibility of applying the paradigm of the concept of sustainable development in the theory and practice of construction companies in Ukraine, which will contribute to the development of auditing at the micro and macro levels. The successful operation of construction companies requires constant monitoring of global trends in society. An important issue in the implementation of the concept of sustainable development - especially due to the fact that it is often seen as evolving - was the identification of its practical and measurable indicators. Such indicators can link different components and reflect the economic, legal, ethical and social aspects of sustainable development. The strategy of sustainable development, according to which construction companies operate, is detailed in the form of specific proposals for the development of individual strategies for enterprise development. Therefore, indicators that indicate the state of development are important. Under such conditions, in order to ensure positive dynamics of development and identify priority areas for further development, it is proposed to analyze the activities of construction companies using the methods of strategic analysis. Applying this approach will allow the management of the construction company to obtain an objective assessment of performance and market positioning. This approach will allow achieving the goals of sustainable development at the local level, to determine the role and functions of all stakeholders that can potentially affect the indicators of the current and projected state of the construction industry (Fig. 1).

Figure 1. Current directions of development of theoretical and practical provisions of sustainable development reports for enterprises of the construction industry of Ukraine.
Construction is one of the types of economic activity that largely provides its products to other sectors of the economy. Under these conditions, the importance of information on the activities of construction companies, which is necessary for owners, shareholders, and managers to justify rational management decisions, choose the most effective management strategy and sustainable economic development of construction companies. The decisions made by investors based on this information contribute to the stable positive dynamics of construction development. [18-20] Various institutions determine the requirements for business entities, and the required number of them is the public interest entities. In construction companies, the rules of real accounting practice are set by internal environments, the main factors in this system of regulation of accounting processes, including accounting policies, internal organizational structure of the business, the behavioral motives of employees and stakeholders. Nowadays, under the conditions of neo-institutionalism, construction companies can independently formulate the conditions for conducting business, regulate the number of employees, expand or, conversely, sound the scale of management and the volume of activities. The volume of construction production is shown in Table 1.

### Table 1. Volume of construction production in 2010-2019.

| Indicators                  | 2010      | 2011      | 2012      | 2013      | 2014      | 2015      | 2016      | 2017      | 2018      | 2019      |
|-----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Construction, mln. UAH      | 42918.1   | 61671.7   | 62937.2   | 58586.2   | 51108.7   | 57515.0   | 73726.9   | 105682.8  | 141213.1  | 181697.9  |
| Residential buildings, mln. UAH | 6876.5   | 8137.1   | 8523.0   | 9953.1    | 11292.4   | 13908.8   | 18012.8   | 23730.0   | 29344.8   | 33208.8   |
| Non-residential buildings, mln. UAH | 12782.6 | 18608.3 | 19581.8 | 18304.2   | 13564.1   | 14998.7   | 20093.6   | 29079.6   | 37446.8   | 50380.5   |
| Civil engineering's, mln. UAH | 23259.0 | 34926.3 | 34832.4 | 30328.9   | 26252.2   | 28607.5   | 35620.5   | 52873.2   | 74421.5   | 98108.6   |

Source: formed by the authors according to the State Statistics Service of Ukraine [13].

Thus, the volume of construction production has been growing every year. In 2019 such growth amounted to UAH 181697.9 million against UAH 141213.1 million in 2018). This indicates that construction companies actively build residential buildings (UAH 33208.8 million against UAH 29344.8 million in 2018), non-residential buildings (UAH 50380.5 million against UAH 37446.8 million in 2018), civil engineering’s (UAH 98108.6 million against UAH 74421.5 million in 2018). While the number of business entities involved in construction is also been growing which is illustrated in Table 2. Total amount of business entities in construction in 2019 is 56855 against 52531 in 2018.

### Table 2. Number of business entities in construction in 2010-2019.

| Years | Total, units | Including natural entities-entrepreneurs, units | In % to the total of business entities of corresponding type of economic activity |
|-------|--------------|---------------------------------------------|--------------------------------------------------------------------------------|
| 2010  | 75221        | 37006                                       | 49.2                                                                           |
| 2011  | 59197        | 21653                                       | 36.6                                                                           |
| 2012  | 50830        | 16753                                       | 33.0                                                                           |
| 2013  | 52983        | 16798                                       | 31.7                                                                           |
| 2014  | 52189        | 22404                                       | 42.9                                                                           |
| 2015  | 55128        | 25963                                       | 47.1                                                                           |
| 2016  | 50208        | 25875                                       | 51.5                                                                           |
| 2017  | 50261        | 22793                                       | 45.3                                                                           |
| 2018  | 52531        | 22941                                       | 43.7                                                                           |
| 2019  | 56855        | 24986                                       | 43.9                                                                           |

Source: formed by the authors according to the State Statistics Service of Ukraine [14].
Consequently, despite all the difficulties associated with the creation, operation, accounting, taxation of construction, there are still new market players seeking to work in construction. The construction industry can be illustrated by concentration calculation indexes which allow to quantify the degree of concentration and intensity of competition in construction [15]. The concentration of construction companies using statistics about net income and profit for 2019 is analyzed in Table 3.

### Table 3. Calculation of the construction industry concentration of Ukraine for 2019.

| No | Enterprise                                      | Si     | HHI    | Market share dispersion index | Entropy index | Sn    |
|----|------------------------------------------------|--------|--------|-------------------------------|---------------|-------|
| 1  | PJSC "Kyivsotsbud"                              | 0.000003 | 0.000000 | 0.0001                       | 0.0000        | 0.0000 |
| 2  | PJSC "Kryvyi Rih Construction Company"          | 0.000004 | 0.000000 | 0.0001                       | 0.0001        | 0.0000 |
| 3  | PJSC "Khersonmonolithud"                        | 0.000005 | 0.000000 | 0.0001                       | 0.0001        | 0.0000 |
| 4  | PJSC "Specialized Construction Management"      | 0.000179 | 0.000000 | 0.0001                       | 0.0015        | 0.0020 |
| 5  | PJSC Ukrainian Special Construction and Assembly Enterprise "Ukrspetsbudmontaz" | 0.000355 | 0.000000 | 0.0001                       | 0.0028        | 0.0037 |
| 6  | PJSC "Management of Construction" Ukrovodbud"   | 0.000923 | 0.000001 | 0.0001                       | 0.0065        | 0.0070 |
| 7  | PJSC "Khmelnytsky Construction and Assembly Department №69" | 0.000530 | 0.000000 | 0.0001                       | 0.0040        | 0.0056 |
| 8  | PJSC "Trust Kyivpidszemshlyakhbud-2"            | 0.001019 | 0.000001 | 0.0001                       | 0.0070        | 0.0110 |
| 9  | PJSC "Construction and installation management № 53"  | 0.001193 | 0.000001 | 0.0001                       | 0.0080        | 0.0122 |
| 10 | PJSC transport construction "Odestransbud"     | 0.001322 | 0.000002 | 0.0001                       | 0.0088        | 0.0160 |
| 11 | PJSC "Complex enterprise of wide-profile construction-2" | 0.004027 | 0.000016 | 0.0000                       | 0.0222        | 0.0481 |
| 12 | PJSC "Middle Dnieper Repair and Construction Specialized Management" PJSC "Berdyanskbud" | 0.000049 | 0.000000 | 0.0001                       | 0.0005        | 0.0004 |
| 13 | PJSC Construction and Installation Department № 26 Odesbud | 0.000095 | 0.000000 | 0.0001                       | 0.0009        | 0.0008 |
| 14 | PJSC "Zhitlomunpostachtorg"                     | 0.000043 | 0.000000 | 0.0001                       | 0.0004        | 0.0002 |
| 15 | PJSC "Komiv-Dniprobud"                         | 0.000067 | 0.000000 | 0.0001                       | 0.0006        | 0.0005 |
| 16 | …                                              | …      | …      | …                            | …             | …     |
| 95 | PJSC "Building Company" Capital "               | 0.000524 | 0.000000 | 0.0001                       | 0.0040        | 0.0050 |
| 96 | PJSC "Mehbudservice"                           | 0.000358 | 0.000000 | 0.0001                       | 0.0028        | 0.0041 |
| 97 | PJSC "Kyivbudinvest"                           | 0.001198 | 0.000001 | 0.0001                       | 0.0081        | 0.0134 |
| 98 | PJSC "Road repair and construction management" | 0.001508 | 0.000002 | 0.0001                       | 0.0098        | 0.0190 |
| 99 | PJSC "Metrobud"                                | 0.001728 | 0.000003 | 0.0001                       | 0.0110        | 0.0222 |
| 100| LLC "Intergal Company"                         | 0.002178 | 0.000005 | 0.0001                       | 0.0134        | 0.0264 |

**Total**  
1.000 0.09628 0.0863 3.0267 8.9929

Source: calculated by the authors according to the financial statements.
The market share of the enterprise by the ratio of its annual income to the total income of all analyzed enterprises is estimated. The total number of enterprises is 100. The market concentration ratio (Si) for the three, five and seven largest companies is calculated:

\[ CR_n = \sum_{i=1}^{n} S_i, i = 1, 2, \ldots, n \]

where \( n \) – the number of largest enterprises in the construction industry for which the indicator is calculated; \( S_i \) – the share of the \( i \)-th enterprise in the construction industry. If the concentration index is close to 100%, it means that the market is characterized by a high level of monopolization. If the concentration index is close to zero, the market can be considered as rather competitive. The market concentration ratio is calculated for the three, five and seven largest Ukrainian construction companies:

\[ CR_3 = 31.2\%; \quad CR_5 = 42.8\%; \quad CR_7 = 56.2\%. \]

The value of \( CR_3 = 31.2\% \) means that the construction market share of 31.2% is occupied by the three largest companies. The five largest companies occupy 42.8% of the market, seven companies – 56.2% of the market of the construction industry of Ukraine. This indicates a high level of competition in the construction market, and obviously there is a lack of monopoly.

In the United States, since 1982, official statistics have completely abandoned the concentration index. The Herfindahl-Hirschman Index (HHI) is used. This index can be considered as an index of concentration, but it does not characterize the market share controlled by several major enterprises, and the distribution of "market power" among all market participants. The indicator is calculated as the sum of squares of market shares (as a percentage) of all market participants in its total volume.

\[ HHI = \sum_{i=1}^{n} S_i^2 \]

where \( S_i \) – the share of the \( i \)-th firm in the construction industry, (%); \( n \) – the number of firms in the construction industry. Thus market shares of the enterprises can be expressed in shares or in percent. The higher the value of the Herfindahl-Hirschman index, the higher the concentration of sellers in the construction market, and conversely, a decrease in the value of the Herfindahl-Hirschman index means increased market competition, reduced concentration and market power of construction enterprises. The Herfindahl-Hirschman Index is calculated: HHI = 620. Since the Herfindahl-Hirschman index is less than 1,500, therefore the market is low-concentrated. It follows that the construction market is characterized as a market of perfect competition. As a matter of fact the agencies consider markets in which the HHI is between 1,500 and 2,500 points to be moderately concentrated, and consider markets in which the HHI is in excess of 2,500 points to be highly concentrated.

Such specific indicators as market share dispersion index, entropy index are also sometimes used in order to better assess the uneven distribution of market shares. The market share dispersion index assesses the degree of deviation of the market share of each developer from the average market share. The market share dispersion index can be calculated by the formula:

\[ \sigma^2 = \frac{1}{n} \sum_{i=1}^{n} \left( S_i - \frac{1}{n} \right)^2 \]

where \( S_i \) – the share of the \( i \)-th firm; \( n \) – the total number of firms in the market.

The smaller the market share dispersion index, the more homogeneous the size of enterprises and the market share of economic entities, the lower the level of concentration. Conversely, the greater the amount of variance, the more uneven the market, the weaker the competition and the stronger the power of large firms [16]. The market share dispersion index is calculated: \( q^2=0.00082 \). Hereby, there are no dominating firms in the construction market of Ukraine.
The entropy ratio is another indicator of the degree of uneven distribution of market shares, which shows the average value of the logarithm of the inverse of market share, weighted by market shares of firms:

\[ E = \sum_{i=1}^{n} S_i \ln \left( \frac{1}{S_i} \right) \]  

(5)

The higher the value of entropy ratio the lower the concentration of sellers in the market, and the lower their ability to influence the market price [17]. If the value of the entropy index is in the range from 0 to 0.5, it means that the market is monopolized, or close to a single monopolization. If the value of the entropy index is in the range from 0.5 to 2.0, it is an oligopolistic market. If the value of the index exceeds 2.0, it indicates a high level of competition in this market.

Using the values of \( S_n \), calculated for each construction company, the entropy ratios of market shares of construction companies is calculated: \( E=3.02 \). Hence, the obtained results indicate a quite high level of competition in the construction. Thus, several indicators for the construction market of Ukraine are analyzed and similar results are obtained.

The construction companies may belong to companies of public interest entities. The basis for the operation of construction companies is the institutional environment, which provides reporting. The Law of Ukraine "On accounting and financial reporting in Ukraine" No 996-XIV applies special reporting and accounting requirements to public interest entities [18]. According to Article 1 construction enterprises can belong to public interest entities as issuers of securities or as big enterprises. Considering that construction is characterized by a significant number of risks (macro-environment, micro-environment, investment, credit, permanent, temporary, economic, legal, project, currency, technical, resource, force majeure), problems with financing and imperfections of the regulatory framework, often low solvency of customers, we believe that construction companies, provided they meet the requirements of the Law of Ukraine № 996-XIV are subjects of high public interest.

4. Conclusions
The activities of economic entities are to some extent a social relationship between users and management personnel responsible for the preparation of financial statements. Active participants in this relationship are users of financial statements, as well as society as the main user of financial statements. It is substantiated that for the development and implementation of a strategy for sustainable development of construction companies should apply a comprehensive approach that allows to take into account the factors that provide an understanding of the company's place in the market with a focus on forecasting.

The construction companies may belong to companies of public interest entities as issuers of securities or as big enterprises. Taking into account the fact that the construction is characterized by a significant number of risks the construction enterprises are supposed to be the subjects of high public interest. The construction industry can be illustrated by concentration calculation indexes which allow to quantify the degree of concentration and intensity of competition in construction. Such indexes are analyzed and according to conducted calculations the next results are obtained: the market concentration ratio illustrates high level of competition in the construction market; according to the Herfindahl-Hirschman Index construction market is characterized as a market of perfect competition; the market share dispersion index illustrates that there are no dominating firms in the construction market of Ukraine; the entropy ratio indicates a quite high level of competition in the construction. The activities of economic entities are to some extent a social relationship between users and management personnel responsible for the preparation of financial statements. Active participants in this relationship are users of financial statements, as well as society as the main user of financial statements. In this context, auditing firms, aware of the growing relevance of sustainable development, are opening a new direction in the provision of professional services in the field of sustainable development, which is primarily reflected in the professional audit services of the Big Four.
Specialists of audit firms systematize the organization's activities in the field of sustainable development by synchronizing internal processes and procedures, stages of development and scale of the organization, in order to achieve a balance between the company's relations with stakeholders and strategic development goals for all users of different reports.

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