Management of sustainable development of the enterprise in the conditions of digitization

Batyr Orazbayev[1]*, *Zheniskul* Utebaeyeva [2], *Gulder* Abayeva [2], *Saule* Bozshaguiova [3], *Elena* Ladanenko [2], and *Liza* Izbassarova [4]

[1] L.N. Gumilyov Eurasian National University, 010008 Astana, Kazakhstan
[2] A. Baitursynov Kostanay Regional University, 110005 Kostanay, Kazakhstan
[3] Kazakh University of Technology and Business, 010003 Astana, Kazakhstan
[4] Kh. Dosmukhamedov Atyrau University, 060011 Atyrau, Kazakhstan

Abstract. The issues of managing the sustainable development of an enterprise in the context of digitalization have been studied. The digitalization process is interpreted as a tool for transforming the enterprise at the levels of control, production and management, which ensures the sustainable development of the enterprise. Describes methods and tools for research and implementation of digitalization to manage enterprise development. Based on the results of the study, a formulation was given for defining the digitalization process for sustainable enterprise management at the present stage of the development of digital technologies and the digital economy. A block diagram of the developed algorithm for assessing the impact of the digitalization process on the sustainable development of an enterprise is constructed and described. The proposed algorithm is based on the use of expert assessment methods in determining the impact of the digitalization process on the sustainable development of an enterprise. In this case, the rating of assessments is based on the index of the impact of the digitalization process on the sustainable development of the enterprise using quartile distribution.

1 JEL classification: C01, C15, D79

1.1 Introduction

Currently, the most effective tool that ensures sustainable management of the development of various enterprises is digitalization. In this regard, the study of the impact of the digitalization process on the sustainable development of enterprises, the creation of tools that assess the impact of digitalization have become a very pressing issue in economics. Introduction of digitalization into the economy, into the process of enterprise development management is the most important trend at the present stage of economic development, but it is impossible to implement digitalization in management using a certain algorithm. Information technology specialists and economists create different models, technologies for

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* Corresponding author: batyr_o@mail.ru

the implementation of digitalization and the transition to a digital economy. Until now, a clear definition of the concept of digitalization has not yet been formulated. It is known that many authors define the digital economy as a new stage in the development of the social and economic system. In this approach to defining the digital economy, it is assumed that the basis for the development of the digital economy is digital technologies that apply various quantitative information. This work make an attempt to identify the term "digitalization"; based on the analysis and generalization of various approaches to defining the concept of digitalization, a clearer definition is proposed based on economic and mathematical methods. The authors of this work, among various options for defining the concept of digitalization, digital economy, chose as a basis the definition given in the document "Strategies for the Development of the Information Society" [1].

In the context of digitalization, the basis of the development strategy of industrial enterprises is the coordination of processes and the creation of a management system based on economic and mathematical methods, models and information technology tools, which is dynamic, i.e. taking into account the influence of time [2]. Digitalization is a tool for transforming business processes, replaces routine processes with automated ones and allows the reorientation of the enterprise to business models that are more flexible and adapted to the current market situation. It can be concluded that digitalization is a necessity for enterprises so that they can develop sustainably based on the use of science-based methods and the introduction of modern technologies and information and communication tools in their activities [3,4]. In this case, can be use formalized (methods of mathematical statistics, econometrics, etc.) and non-formalized methods (methods of expert assessment, verbal analysis, etc.). Digitalization can be thought of as both a concept and a process. As a concept, digitalization allows the development of the economy based on the automation of production and technological processes. And as a process, digitalization determines the steps that are necessary for the transition to a digital economy, through the introduction of modern methods and means of information technology, as well as innovation [5].

The main stages of development of the digital economy include the stages of "digitalization" and "digital transformation". The stage of development of the digital economy can be represented in the form of a diagram shown in Figure 1.
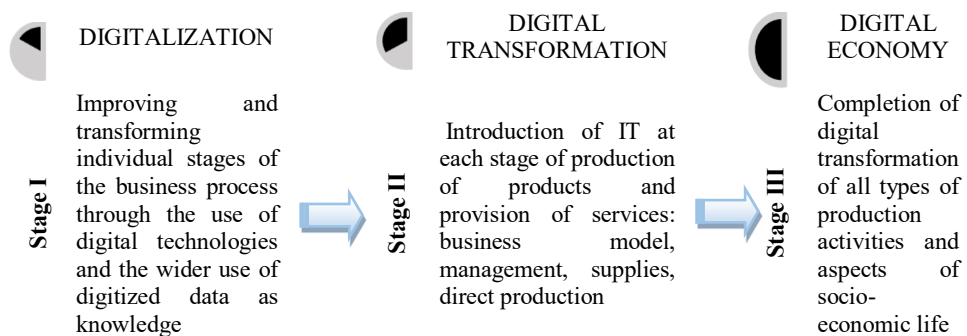
Fig. 1. Stages of development of the digital economy
Source: built by the authors

Thus, according to the authors, digitalization can be interpreted as a tool for transforming an enterprise at the levels of control, production and management, ensuring its sustainable development. At the "Digitalization" stage of the above diagram of the development of the digital economy, new developments are created based on innovations and IT solutions [6,7]. At the same time, labor productivity and the efficiency of production processes increase, and communications with consumers, suppliers and the government improve. At the stage of

digital transformation, information technologies are introduced at every stage of production or provision of services, from the supply of raw materials to the sale of finished products of the enterprise.

2 Materials and methods of research

In this work, the research materials are the processes of digitalization of oil refining production enterprises, aimed at effectively managing their sustainable development. Currently, leading oil refineries and other industries are interested in implementing digitalization tools to manage the successful development of production. It implementing programs that ensure the effective organization of the process of monitoring and managing production and technological processes: platforms that allow for the transparent selection of suppliers or contractors, which is very relevant in the context of growing anti-corruption requirements. The interest and desire of an enterprise for digitalization is also determined by such internal needs as ensuring product quality, increasing income and management efficiency, and such external influences as tightening competition and legislation, and market development. To research and implement digitalization processes in enterprises, the following are used:

– economic and mathematical methods, which are effective methods for studying and managing complex economic objects and production processes [8−10];
– methods and means of information technology [11−13];
– methods of economic analysis [14,15], statistical analysis [16] systems analysis [17,18], and other scientific methods.

The authors, based on the results of research and generalization of various approaches to defining the digitalization process, formulated the following definition of the digitalization process. "Digitalization represents a deep transformation of an enterprise's business processes at all levels of production through the use of digital technologies, based on the optimization of business processes and the effective management of interaction processes with customers, consumers, and enterprise personnel". This work examines the issues and methods of managing the sustainable development of an enterprise in the context of digitalization, the relationship between digitalization and the sustainable development of an enterprise. Thus, the digital economy is a market that is based on digital technologies. Digital technologies accelerate the production processes of industrial enterprises, such as the production of petroleum products and their distribution through e-commerce. The widespread introduction of Internet technologies has made it possible to create global network business structures that include networks of producers, consumers and suppliers [19]. All this allows us to minimize production costs and efficiently use enterprise resources, and also ensures full satisfaction of consumer demand. Therefore, digitalization can be considered as the main factor ensuring the sustainable development of oil refining and other industries.

Currently, for the sustainable development of industrial enterprises it is necessary to develop and introduce innovations and new technologies. At the same time, digitalization ensures intensive development of production, improves the economic performance of the enterprise, and also allows for the effective implementation of the principles of sustainable development. This is explained by the fact that digitalization makes it possible to create and introduce cost-effective, environmentally safety methods and technologies into production. Another important function of digitalization is to simplify and ensure operational interaction between suppliers, consumers and other parties, i.e. expanding and increasing the efficiency of communication channels. In this regard, in the proposed work, the term "sustainable development" is understood as the joint development of the economy and ecology, as well as society in the conditions of widespread digitalization [20].

It should be noted that today there is a significant effect from the introduction of

digitalization in order to use the concept of sustainable development of various oil refining enterprises and other industries. The introduction of the Internet and digital technologies greatly speeds up the process of interaction and exchange of information between enterprises around the world. In the oil refining industry of the Republic of Kazakhstan, the introduction of digitalization and the development of information technologies are being stimulated, ensuring an increase in productivity and production efficiency. This digitalization process makes a significant contribution to their sustainable development and ensures an improvement in the economic and environmental condition of enterprises.
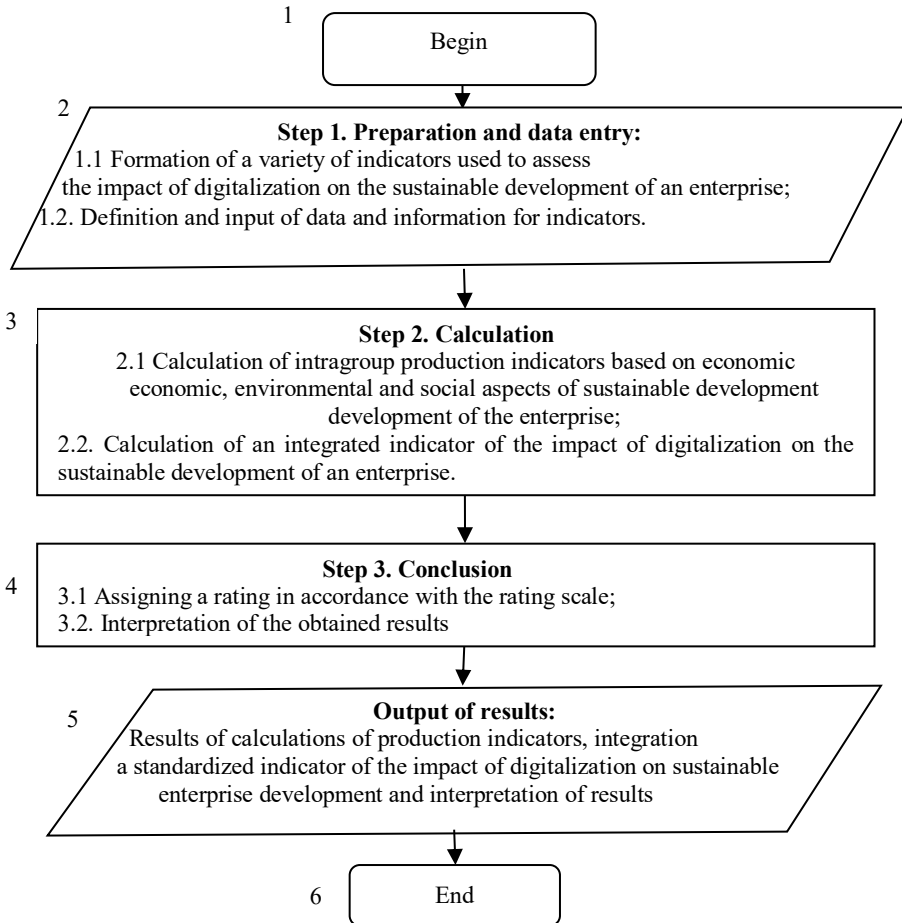
Based on the conducted theoretical research and analysis of relevant sources, we can conclude that at present, in the processes of assessing the level of sustainable development of an enterprise, the digitalization factor is not adequately taken into account. This requires a systematic study of the impact of digitalization on the company's sustainable development process. Summarizing the results of the study, we can conclude:

1. Digitalization is widely introduced and applied in production, socio-economic sphere and there was a need to create an algorithm for assessing the impact of digitalization on the processes of sustainable management of enterprise development;
2. It is necessary to identify mechanisms that allow assessing the impact of digitalization on the implementation of the concept of sustainable development and adequately assessing the effect of the introduction of digital technologies in the processes of development and implementation of the company's sustainable development strategy.

To formulate the proposed algorithm for assessing the impact of digitalization on the development of the company, used a tool for comparing analogies with known methods for assessing sustainable development and digitalization. It also takes into account the frequency at which relevant information is displayed in financial and non-financial reports, internal and open sources of the enterprise.

3 Results

The main steps and points (sub-steps) of the proposed enlarged algorithm for assessing the impact of digitalization on the sustainable development of the companies under study are presented in Figure 2.

1

Begin

2

Step 1. Preparation and data entry:
1.1 Formation of a variety of indicators used to assess
the impact of digitalization on the sustainable development of an enterprise;
1.2. Definition and input of data and information for indicators.

3

Step 2. Calculation
2.1 Calculation of intragroup production indicators based on economic
economic, environmental and social aspects of sustainable development
development of the enterprise;
2.2. Calculation of an integrated indicator of the impact of digitalization on the
sustainable development of an enterprise.

4

Step 3. Conclusion
3.1 Assigning a rating in accordance with the rating scale;
3.2. Interpretation of the obtained results

5

Output of results:
Results of calculations of production indicators, integration
a standardized indicator of the impact of digitalization on sustainable
enterprise development and interpretation of results

6

End

Fig. 2. Flowchart of an algorithm for assessing the impact of the digitalization process on the sustainable development of an enterprise
Source: built by the authors

Let's look at the details of the main steps of the presented algorithm.

The first point of step 1 (block 2) is 1.1 Formation of a set of indicators to assess the impact of digitalization on sustainable development, designed to generate the necessary indicators used to assess the impact of digitalization on the sustainable development of an enterprise. In this case, the set of necessary indicators is implemented as follows:

1.1.1. Combining indicators by type of sustainable development of an enterprise;
1.1.2. With the involvement of experts, determining the weighting coefficients for each type of sustainable development of the company;
1.1.3. The consistency of expert opinions is checked, for example, based on the concordance coefficient.
1.1.4. If consistency is achieved, then the arithmetic average of the experts' assessments is taken as weighting coefficients.
1.1.5. If consistency is not achieved, then the coefficient of variation is calculated, i.e. the average is checked for typicality. If the check result is positive, it is go back,.
1.1.6. The condition "Mode frequency <3" is checked. If yes, then the median value of expert assessments is taken as weighting coefficients. If not, i.e. when "Mode frequency $\geq$ 3", the modal value of the experts' assessments is taken as weighting

coefficients.

In the second paragraph of step 1, data and information for the indicators are defined and entered. Determining the sources of information on open-source indicators published by the company to be based on official data and ensure transparency and openness. These sources include the official website, reports, internal documents of the enterprise. It can be noted that the selected indicators for assessing the degree of influence of digitalization on the sustainability of the enterprise can be supplemented, in addition to the data published by the enterprise, with those indicators that can assess the impact of digitalization on the sustainability of the enterprise under study.

Now let's consider the detailed points of step 2 of the proposed algorithm for assessing the impact of digitalization on the process of sustainable development of an enterprise.

In the first paragraph of step 2 (block 3), the calculation of intragroup production indicators on economic, environmental and social aspects of sustainable development is carried out according to the following subparagraphs:

2.1.1 Standardization is carried out, i.e., experts determine the boundaries for converting quantitative indicators into qualitative ones.

2.1.2 The coefficient of variation is calculated and the consistency of expert opinions is checked. If the experts' opinions are agreed upon, then the boundaries are determined as the arithmetic average of the experts' assessments and proceed to subclause.

2.1.3. If agreement between the experts is not achieved, then the condition "Mode frequency <3" is checked. When this condition is met, the boundaries are defined as the median value of expert assessments and the transition to subclause 2.1.3 Otherwise, i.e. at "Mode frequency ≥ 3», boundaries are defined as the modal value of expert assessments and transition to subclause 2.1.3. 2.1.3 Sub-indices are calculated to assess the impact of digitalization on the sustainable development of the enterprise.

In paragraph 2.2 of step 2 (block 3), the integrated indicator of the impact of digitalization on the sustainable development of the enterprise is calculated. This paragraph includes the following subparagraphs:

2.2.1 Defining rules for combining subindices into a general index;

2.2.2 Calculation of an integrated indicator of the impact of digitalization on the sustainable development of an enterprise.

In step 3 of the proposed algorithm for assessing the impact of the digitalization process on the sustainable development of society, a Conclusion is formed (block 4, Figure 2). At this step of the developed algorithm for assessing the impact of digitalization on the stability and sustainability of enterprise development, experts assign ratings taking into account the index of the impact of the digitalization process on the sustainability of enterprise development. In addition, at this final step, the obtained values are interpreted and compared with the indicators of other enterprises or within one enterprise in terms of dynamics.

Accordingly, the final step consists of the following points:

3.1 Assignment of ratings by experts based on the rating scale;

3.2 Interpretation, i.e. explanation and comparison of the obtained values.

To assign a rating by experts based on a scale for assessing the impact of the digitalization process on the sustainability of a company's development, a gradation based on quartile distribution is proposed. According to the authors of this work, this approach ensures an even division of the final values into 4 levels. Ratings selected by experts based on the index of the impact of the digitalization process on the sustainability of the company's development are presented below in Table 1.

As can be seen from Table 1, the impact of digitalization on sustainable development is assessed using a 4-point scale system: A; B; C; D. In this case, A denotes "strong influence", B – "medium influence", C – "weak influence" of the digitalization process on the

sustainability of enterprise development, and D – digitalization does not affect sustainable development.

The essence of paragraph 3.2, the third step, is interpretation, i.e. explanation and comparison of the obtained values. For example, if an enterprise receives a rating, then it is concluded that the activity of the enterprise significantly depends on the digitalization process. In this case, enterprise managers use modern digital technologies as the main tool for the development of the enterprise and to improve interaction with partners, suppliers and consumers, and others.

Table 1. Rating of assessments based on the index of the impact of the digitalization process on the sustainable development of the enterprise based on quartile distribution.

Index Intervals	Rating	Interpretation of values
from 0 to 0.25	A	Digitalization is used as the main tool for ensuring the progress of sustainable development of an enterprise
from 0,25 to 0,50	B	At the same time, digitalization is actively used to ensure progress in the field of sustainable development of the enterprise
from 0,50 to 0,75	C	Digitalization is poorly applied to ensure progress in the field of sustainable development of the enterprise
from 0,75 to 1,0	D	Digitalization is not used to ensure progress in the field of sustainable development of the enterprise

Note – compiled by the authors based on research

This rating approach to assessing the impact of the digitalization process on the sustainable development of an enterprise allows for analysis and self-assessment of the enterprise's performance and identification of weaknesses in which it lags behind other competing enterprises. Based on the results of the analysis of the enterprise's activities, it is possible to find out which tools digitalization allows to transform its activities, how digitalization affects production and the sustainability of the enterprise's development.

4 Discussion

Kazakhstan has sufficient potential and conditions for the sustainable development of oil refineries based on the further introduction of digital technologies for managing production and technological processes.

In accordance with the proposed algorithm for assessing the impact of the digitalization process on the sustainable development of an oil refinery at the first step:

- a set of indicators is generated that are used as criteria when assessing the impact of digitalization on its sustainable development, and selected data is entered to calculate or evaluate the value of the criterian;
- data entry to calculate or evaluate the value of criterian.

The formation of a variety of criteria for assessing the impact of digitalization on the sustainable development of an oil refinery is implemented on the basis of expert assessment methods in subparagraphs 1.1.1–1.1.6 described in Section 3.

When entering data to calculate or evaluate the value of criteria, sources of data for determining criteria are open sources from the official website of the enterprise, production data and reports of the enterprise, as well as information from experts, specialists obtained on the basis of expert assessment methods. At the same time, those parts of the information that are received from experts and expressed in natural language, i.e. fuzzy information, are

further formalized and processed using the methods of fuzzy set theories, which makes it possible to move to a digital format from a verbal form. Then the fuzzy information received from experts becomes suitable for processing by digital technology.

In block 3 of the proposed algorithm for assessing the impact of digitalization on the sustainable development of the enterprise, intra-group production indicators of sustainable development are calculated according to the following subparagraphs 2.1.1 and 2.1.2 described in section 4-results. Then sub-indices are calculated to assess the impact of digitalization on the sustainable development of the enterprise.

Integrated indicators of the impact of digitalization on the sustainable development of an enterprise are determined in subclause 2.2.2 of step 2.

At the final step of the described algorithm, rating scores are derived taking into account the index of the influence of the digitalization process on the sustainability of the enterprise's development and the results obtained are interpreted, and these results are compared with similar indicators of other competing enterprises in the industry. This allows to make decisions to eliminate weaknesses that are the reasons for lagging behind competing enterprises and to select the necessary digitalization tools to achieve sustainable development of the enterprise and provide it with leadership in the industry. Currently, leading enterprises, including the oil refining industry, in order to maintain their position as a leader in the field of activity, are actively introducing modern digital technologies in their activities and plan to further expand digitalization in enterprise strategies to achieve sustainable development.

5 Conclusion

The results of a study of the issues of managing the sustainable development of an enterprise are presented using the example of oil refineries in Kazakhstan in the conditions of digitalization. The main results and conclusions of the study include:

– An algorithm has been developed to assess the impact of digitalization on the sustainability of the company's development, which is based on determining and taking into account the index of the impact of digitalization on the sustainability of the company's development and can be flexible and take into account the dynamics of change;

– a description of the main steps (preparation and data entry; calculation; conclusion; output of results) of the proposed algorithm for assessing digitalization for the sustainable development of an enterprise is provided;

– the proposed algorithm for assessing digitalization on the sustainable development of an enterprise is based on the use of various data and enterprise reports and expert assessment methods;

– the determined rating of assessments based on the index of the impact of the digitalization process on the sustainable development of the enterprise is based on the quartile distribution.

– based on the rating approach to assessing the impact of digitalization on the sustainable development of an enterprise, an analysis and self-assessment of the enterprise's performance is carried out, which allows us to identify weaknesses that lead to lags behind competing enterprises. Then the management of the enterprise makes a decision to eliminate these weaknesses by improving the digitalization process and introducing innovative technologies

Based on the above, we can conclude that for oil refineries in Kazakhstan, the introduction and improvement of digital technologies should be the most important, priority and strategic direction, ensuring their sustainable development.

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