ISSN 2616-7433 Vol. 6, Issue 2: 43-50, DOI: 10.25236/FSST.2024.060207

Optimization of Dual Circulation Direction Support System Using Digital Technology

Xiaojian Lu

Business School, Dongguan City University, Dongguan, Guangdong, 523000, China
1828578985@qq.com

Abstract: *Faced with the impact of COVID-19, there has been a trend of anti-globalization in the international community. How to build a new development pattern with China's major circulation as the main focus and China's international dual circulation promoting each other is a common concern of all sectors of society. This article presents the relationship between the development of the digital economy and the economic environment. The digital economy provides new impetus for the new "dual circulation" development pattern. This article utilizes digital technology to optimize the data collection module in a decision support system for the dual circulation direction, collecting various types of data related to the dual circulation of the digital economy, including but not limited to economic data, policy data, market data, etc. The basic function of the data mining module is to analyze the selected data table, find corresponding relationships, patterns, trends, etc., and provide decision-making basis for decision-makers. The comparison of system memory consumption under different decision task scales and experimental conditions shows that the traditional dual loop direction decision support system consumes 800MB of memory under small task decision task scales. The optimized system consumes 600MB of memory at a small task decision task scale. The decision support system in this article has powerful data processing and analysis capabilities, which can help decision-makers grasp the economic situation and formulate effective strategies.*

Keywords: *Dual Circulation Direction, Decision Support Systems, Digital Technology, Digital Economy, Data Mining*

1. Introduction

The digital economy system is the digital embodiment of the modern economic system, centered on the "industrial brain+future factory", supporting digital industrialization and industrial digitization, and promoting the deep integration of industry, agriculture, service industry, and information industry. A modern industrial system that integrates production, distribution, circulation, and consumption, optimizes factors and services, and synergizes the development of the real economy with technological innovation, modern finance, and human resources can improve economic quality, competitiveness, and modernization. In order to address the current situation of low quality, inadequate structure, weak innovation and competitiveness in economic development, utilizing digital technology to optimize the dual circulation direction of decision support systems can accurately identify the main factors hindering sustained and healthy economic development. The focus can be on consolidating economic development, improving the quality of economic development, and accelerating the establishment of a modern economic system with digital economy as its main feature.

This article first provides the background of constructing a decision support system that utilizes digital technology to optimize the dual circulation direction, and points out the current situation of the development of the digital economy. Then it presents the module design of a decision support system that utilizes digital technology to optimize the dual loop direction. Finally, the traditional dual loop decision support system and the system optimized by digital technology are used to explain the decision results. By comparing the interpretability of the two, this article evaluates whether the optimized system provides clearer and more reasonable decision explanations to help decision-makers understand, accept, and adopt the decision recommendations provided by the system.

2. Related Work

The essence of the new development pattern of "dual circulation" is to change the traditional

ISSN 2616-7433 Vol. 6, Issue 2: 43-50, DOI: 10.25236/FSST.2024.060207

development model, shifting from the previous export-oriented model to the current new model of balanced growth and mutual promotion of China's international economy. Pu Qingping believed that in the context of unprecedented changes in the world today, a new development pattern of "dual circulation" should be established. This is very meaningful for breaking through the new predicament of China's economic development, promoting the sustainable development of the socialist economy with Chinese characteristics, and promoting a new round of global economic recovery [1]. Wang Juanjuan believed that the focus should be on the growth of the scale of foreign economic and trade cooperation and the degree of industrial correlation, guided by the construction of a complementary and interdependent industrial chain in the world. He promoted the development of "double circulation" through the "the Belt and Road" region through the "new channel" [2]. Qian Xuefeng believed that fundamentally speaking, the internal driving force for building a "dual circulation" and cultivating new international cooperation and competitive advantages is the key to building a new pattern. It should be based on national strategy, leverage the characteristics of China's huge market, multi-level consumer market, and unified large market, and build the internal driving force of dual circulation [3]. Siqi Yan believed that the proposal of the new development pattern of "dual circulation" indicates that China has entered a new stage of development, and is also an important sign of the continuous improvement of China's opening-up to the outside world. Therefore, in the new development pattern of "dual circulation", there should be an accurate grasp of the connotation and development trend of accounting [4]. The sudden outbreak of COVID-19 and the trade friction launched by the United States have had a great impact on China's economic development. Peng Xiaobing believed that the new development pattern of "dual circulation" should be taken as the starting point to stimulate the vitality of civil society, innovate government governance, economic governance, and social governance systems, and create a trust, confidence, and predictable development environment [5]. Their research did not combine digital technology to optimize the development of dual circulation.

The externalities of the traditional platform business ecosystem have expanded the participation of platform participants, and data has become a trace and accessory of platform users and various network behaviors, promoting the deep integration of industrial digitization and digital industrialization. This leads to genetic mutations in data, transforming it into a "cloud network end" digital asset and providing services for various application scenarios in the physical space. Therefore, data resources are transformed into an indispensable asset, participating in enterprise operations and achieving a win-win situation. Based on this, this article takes "platforms" as the research object and explores the formation mechanism, innovation driving mechanism, and "life evolution" law of "digital economic ecology" supported by dual circulation and digital technology [6-7].

3. Method

3.1 Digital Economy

To bridge various information gaps, it is necessary to rely on digital technology to achieve industrial operation of data and create value based on demand flow, which is called the leap of "digital capital" [8]. The platform has ownership and usage rights over digital assets. Through the original innovation results generated by data industrialization, it guides users on both sides of the platform to accurately connect with enterprise services, reduce transaction costs, and improve social efficiency. This new business and organizational model has brought revolutionary changes to the world economy, making the boundaries of companies increasingly blurred and the isolation between enterprises and markets broken, surpassing the concept of a "business ecosystem" in the past. The digital economy has become a new economic form due to its inclusiveness. The digital economy ecosystem is composed of interconnected infrastructure, users, and industries, as well as their scale, penetration rate, and other ecological environment elements.

Digital systems refer to the economic activities of enterprises and users, driven by digital technology and a dual market, in the economic environment. They are the products of the era that have developed rapidly in the economic environment. It is a new industrial economic system that transforms economic information and market behavior into digital interactive effects, and is often considered to be a series of economic behaviors empowered by the interaction and circulation of data and industrial information in virtual networks. Digitization has spatial heterogeneity and distribution characteristics. The digital economy has high penetration rate, fast speed, increasing marginal benefits, and sustainable development. Its essence is informatization [9-10]. With the rapid development of the digital economy, profound changes have occurred in the competitive strategy, organizational structure, corporate culture,

ISSN 2616-7433 Vol. 6, Issue 2: 43-50, DOI: 10.25236/FSST.2024.060207

and other aspects of enterprises [11].

Optimizing decision support systems in the dual loop direction using digital technology involves multiple aspects, including data preprocessing:

$$X' = X \times W + b \tag{1}$$

Among them: X' is the data after linear transformation and offset processing, W is the weight matrix, and b is the offset.

Decision tree classification:

$$Y = f(X) \tag{2}$$

Among them, Y is the classification result, which is used to map input features to the classification result

Logistic regression model:

$$P(Y = 1 \mid X) = \beta 0 + \beta 1X1 + \beta 2X2 + \ldots + \beta nXn \tag{3}$$

$P(Y = 1 \mid X)$ is the probability of being classified as 1 under the given feature X

Principal Component Analysis:

$$z_f = T \times q + E \tag{4}$$

T is the principal component matrix, and q is the factor loading matrix used to associate the principal components with the original features. E is the residual matrix.

3.2 Digital Economy Provides New Impetus for the New "Dual Circulation" Development Pattern

The digital economy is providing new impetus for Chinese economic recovery [12-13]. After the outbreak of the global financial crisis, China first achieved economic recovery and continued to maintain a stable recovery momentum. To achieve this goal, it is necessary to rely on the digital economy to support it [14]. Internally, the digital economy can provide impetus for China's traditional industries, thereby accelerating the transformation and upgrading of industries and the development of innovation [15]. Internationally, the rapidly developing digital economy and digital technology have enabled China to break through the bottleneck of the supply side, thereby achieving upgrades in the global value chain. On the one hand, expanding demand should be placed in an important strategic position. On the other hand, its high-quality digital economy and continuously innovative digital technology have promoted the modernization of Chinese industrial and supply chains. This can promote the improvement of economic quality and efficiency, core competitiveness, and promote safe and efficient connection with the international circulation.

3.3 System Module Design

(1) Data collection module

This article collects various types of data related to the dual circulation of the digital economy, including but not limited to economic data, policy data, market data, etc.

(2) Report module

1) Multi topic report

The main function of multi topic report management is to complete data analysis on multiple topics. Users can customize reports on multiple topics as needed, and can also modify, approve, cancel, delete, and other operations on the modified reports. They also need to have functions such as calling models, generating graphics, exporting, and printing.

Multi topic report presentation: The main functions required for the report include model calling, graphic generation, output, printing, etc.

2) Multidimensional analysis report

It is generated when performing temporary queries on data from multiple dimensions and can store the required information for future use. It needs to achieve both the management of multidimensional analytical reports and the expression of multidimensional analytical reports, which includes both the

ISSN 2616-7433 Vol. 6, Issue 2: 43-50, DOI: 10.25236/FSST.2024.060207

management and display aspects.

Multidimensional analysis report management: In terms of management, it is necessary to efficiently manage multi-dimensional analysis reports. To complete the addition, deletion, modification, and query of multi-dimensional analysis reports, it is also necessary to complete audit reports, cancel audit reports, display report data, preview reports, drill down, etc.

Multidimensional analysis report display: The display requirements should be reflected on the display interface, including querying, viewing, drilling down, generating charts, printing, and exporting files.

(3) Improvisation inquiry module

The main requirement is to enable users to access the required information in the shortest possible time, anywhere, facing the data warehouse. Instant questioning includes two modes: single topic and multiple topics.

Single topic: Its main function is to complete data analysis on individual topics. Users can select the desired dimension and its members when performing data segmentation. When selecting dimensions, the hierarchical information and level information contained in each dimension can be presented in the form of a report. The functions of reports include: data drilling, slicing of dimensional data, grouping of data, correct arrangement of data in each column, output function, and printing function.

Multi topic: The main function is to complete data analysis on multiple topics. Users can select the desired dimension and its members when performing data segmentation. When selecting dimensions, the hierarchical information and level information contained in each dimension can be presented in the form of a report. The functions of reports include: data drilling, slicing of dimensional data, grouping of data, correct arrangement of data in each column, output function, and printing function. Temporary queries can be performed on comprehensive class diagrams for reports on multiple topics.

Statistical Analysis and Predictive Statistics: The module is mainly used to analyze the changes in important and noteworthy economic indicators, and then use various models and methods to predict their development trends based on the changes in these data.

(4) Data mining module

The basic function is to analyze the selected data table, find corresponding relationships, patterns, trends, etc., and provide decision-making basis for decision-makers. Users can choose tables, conditions, parameters, objects, data quantities, etc., and display the information or calculation results of the model to decision-makers.

(5) Economic model

1) Management Economic Model

This enables functions such as uploading, querying, browsing, modifying, deleting, auditing, and downloading economic models.

2) Economic simulation model presentation

There are two main functions: search mode and download mode. In this system, users can use economic models to query, download, and analyze the required economic models.

(6) Decision support module

This provides decision-makers with visual data analysis and decision-making advice, helping them develop scientifically sound strategies.

4. Results and Discussion

4.1 Comparison Experiment of Decision-Making Efficiency

This article evaluates the efficiency improvement of a dual loop decision support system by comparing the computational time and resource consumption of traditional and optimized systems. It uses decision tasks of different scales and complexities for testing, and records metrics such as computation time and CPU (Central Processing Unit) utilization for evaluation.

The system calculation time and CPU utilization under different decision task scales and

ISSN 2616-7433 Vol. 6, Issue 2: 43-50, DOI: 10.25236/FSST.2024.060207

experimental conditions are shown in Table 1. In Experiment No. 1, the traditional dual loop direction decision support system takes 180 seconds to compute and has a CPU utilization rate of 65% at a small task decision task scale. The optimized system has a computing time of 80 seconds and a CPU utilization rate of 45% for small task decision tasks. In Experiment No. 3, the traditional dual loop direction decision support system takes 700 seconds to compute and has a CPU utilization rate of 95% for large-scale task decision tasks. The optimized system has a computation time of 300 seconds and a CPU utilization rate of 80% for small task decision tasks.

Table 1: System calculation time and CPU utilization under different decision task scales and experimental conditions

Serial number	Experimental condition	Decision task size	Calculation time (s)	CPU utilization (%)
1	Traditional dual circulation direction decision support system	Small tasks	180	65
	Optimized system	Small tasks	80	45
2	Traditional dual circulation direction decision support system	Medium tasks	350	80
	Optimized system	Medium tasks	150	60
3	Traditional dual circulation direction decision support system	Large task	700	95
	Optimized system	Large task	300	80

4.2 Memory Consumption

The system memory consumption under different decision task scales and experimental conditions is shown in Table 2. In Experiment 1, the traditional dual loop direction decision support system consumes 800MB of memory at a small task decision task scale; the optimized system consumes 600MB of memory at a small task decision task scale.

Table 2: System memory consumption under different decision task scales and experimental conditions

Serial number	Experimental condition	Decision task size	Memory consumption (MB)
1	Traditional dual circulation direction decision support system	Small tasks	800
	Optimized system	Small tasks	600
2	Traditional dual circulation direction decision support system	Medium tasks	1500
	Optimized system	Medium tasks	1000
3	Traditional dual circulation direction decision support system	Large task	3000
	Optimized system	Large task	2000

4.3 User Satisfaction Survey

Through a survey questionnaire targeting users, this article collects their satisfaction evaluations of traditional systems and optimized systems. The survey includes aspects such as the usability of the decision-making process, the reliability and practicality of decision results, in order to understand the feedback of respondents on the system optimized by digital technology.

The user satisfaction survey is shown in Figure 1. The usability of the decision-making process is scored at 5 points (very satisfied), accounting for 20%, and 4 points (satisfied), and accounting for 30%. The reliability of the decision results is 25% for a score of 5 (very satisfied) and 35% for a score of 4 (satisfied).

ISSN 2616-7433 Vol. 6, Issue 2: 43-50, DOI: 10.25236/FSST.2024.060207

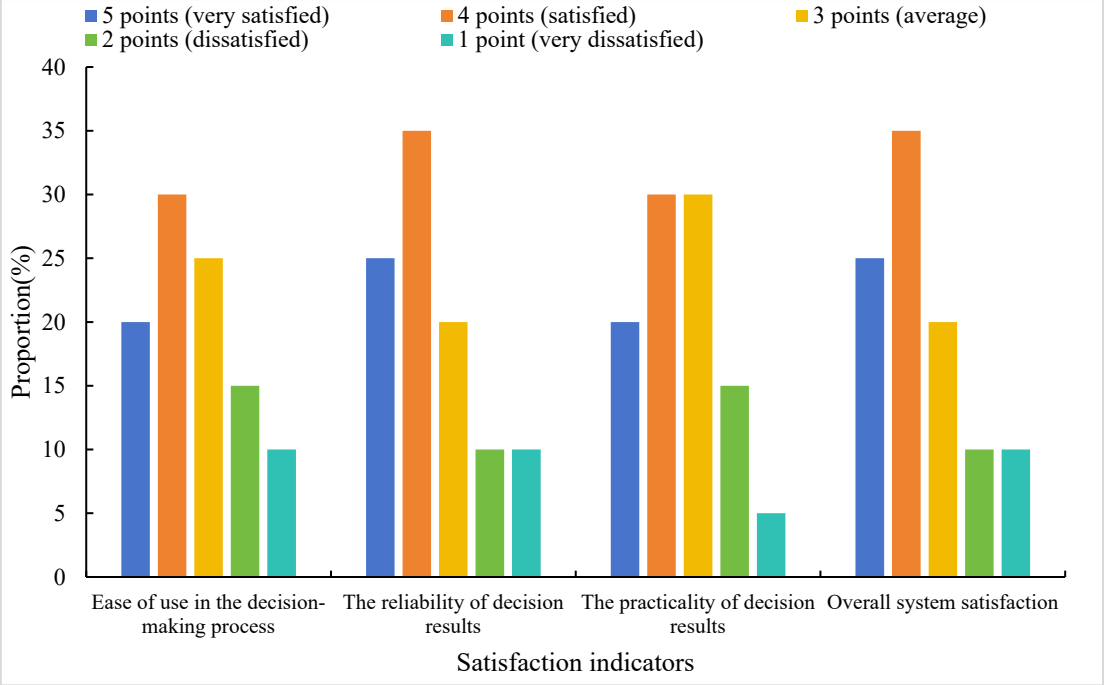

Figure 1: User Satisfaction Survey

4.4 Decision Interpretability Experiment

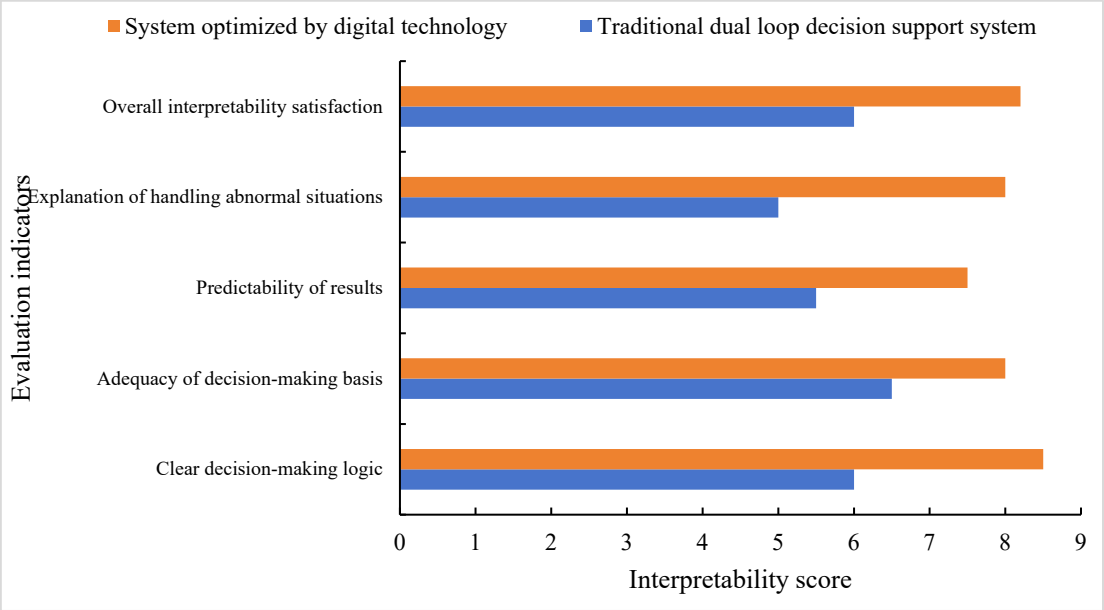

Figure 2: Interpretability score of traditional dual loop decision support system and digital technology optimized system

This article uses traditional dual loop decision support systems and digital technology optimized systems to explain the decision results. By comparing the interpretability of the two, it is possible to evaluate whether the optimized system provides clearer and more reasonable decision explanations to help decision-makers understand, accept, and adopt the decision recommendations provided by the system.

The interpretability scores of traditional dual loop decision support systems and digital technology optimized systems are shown in Figure 2. In terms of decision logic clarity, the interpretability score of the traditional dual loop decision support system is 6.0 points, and the interpretability score of the system optimized by digital technology is 8.5 points. In terms of adequacy of decision-making basis, the interpretability score of the traditional dual loop decision support system is 6.5 points, and the

ISSN 2616-7433 Vol. 6, Issue 2: 43-50, DOI: 10.25236/FSST.2024.060207

interpretability score of the system optimized by digital technology is 8.0 points.

4.5 Knowledge Extraction and Decision Rule Validation

This article conducts experiments on knowledge extraction and rule validation of standard problems in practical decision-making scenarios using an optimized system. This article applies the system to decision-making problems in specific fields and evaluates the knowledge richness and rule effectiveness of the system based on existing knowledge bases and decision rules.

The evaluation indicators and corresponding scores for system knowledge extraction and decision rule validation are shown in Figure 3. The richness score of factual knowledge is 8.5 points, and the accuracy score of rule-based knowledge is 9.0 points.

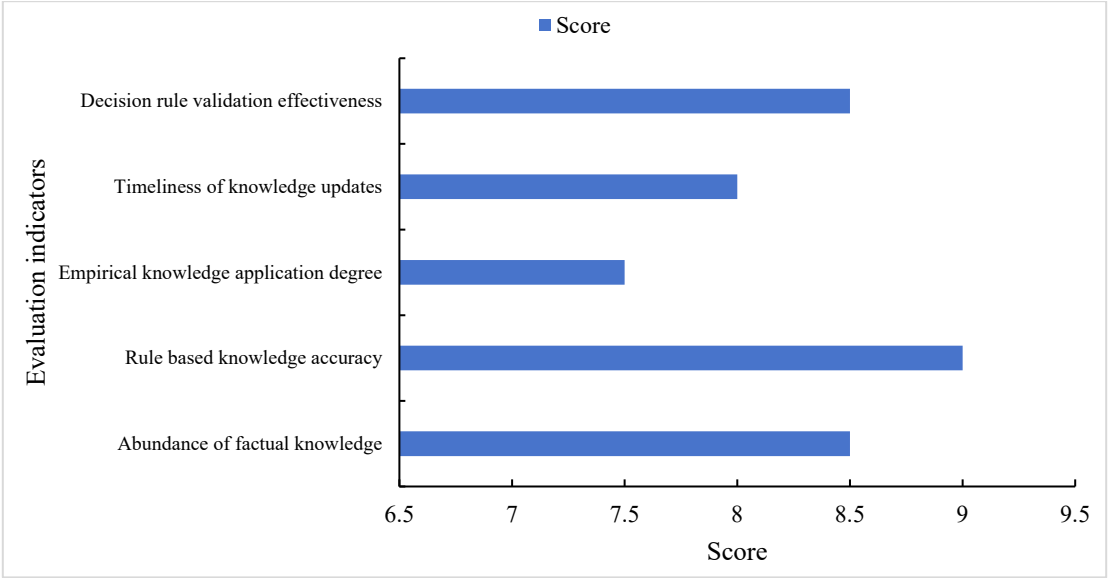

Figure 3: Evaluation metrics and corresponding scores for system knowledge extraction and decision rule validation

5. Conclusions

In the decision support system in the direction of digital technology optimization double cycle, consumers and enterprises have promoted the digitalization and deep integration of the industry through the Internet connection through the platform. The evaluation indicators and corresponding scores for knowledge extraction and decision rule validation in this article show high scores for factual knowledge richness and rule-based knowledge accuracy. The digital economy is an emerging form of economy that has shown strong vitality and enormous development potential while responding to the impact of the epidemic. From the perspective of the development trend and reflected energy efficiency of the digital economy, it has become an important means to promote the construction of a new development pattern of "dual circulation", and is also the key to achieving national strategic transformation. In the future, it is necessary to fully utilize the innovative functions of the digital economy and form the inherent driving force of a new development pattern of "dual circulation".

References

[1] Pu Qingping, Yang Conglin. The realistic logic, implementation path and era value of constructing a new development pattern of double cycle. Journal of Chongqing University (Social Sciences Edition)), 2020, 26(6): 24-34.

[2] Wang Juanjuan. The new channel connects the Belt and Road and the domestic and international dual cycle-based on the perspective of the industrial chain. China's circulation Economy, 2020, 34(10): 3-16.

[3] Qian Xuefeng, Pei Ting. The new development pattern of domestic and international double cycle: Theoretical Logic and endogenous vitality. Journal of Chongqing University (Social Sciences Edition)), 2021, 27(1): 14-26.

ISSN 2616-7433 Vol. 6, Issue 2: 43-50, DOI: 10.25236/FSST.2024.060207

[4] Siqi Yan. The new development pattern of double cycle and accounting. Finance and Management International Academic Forum, 2022, 1(1): 39-41.
[5] Peng Xiaobing and Wei Dongping. Activating the vitality of civil society: the origin, foundation and governance of the new development pattern of double cycle. Journal of Chongqing University (Social Sciences Edition), 2020, 26(6): 35-43.
[6] Whitelaw S, Mamas M A, Topol E, et al. Applications of digital technology in COVID-19 pandemic planning and response. The Lancet Digital Health, 2020, 2(8): 435-440.
[7] Vargo D, Zhu L, Benwell B, et al. Digital technology use during COVID-19 pandemic: A rapid review. Human Behavior and Emerging Technologies, 2021, 3(1): 13-24.
[8] Hilbert M. Digital technology and social change: the digital transformation of society from a historical perspective. Dialogues in clinical neuroscience, 2020, 22(2): 189-194.
[9] Sturgeon T J. Upgrading strategies for the digital economy. Global strategy journal, 2021, 11(1): 34-57.
[10] Jiang X. Digital economy in the post-pandemic era. Journal of Chinese Economic and Business Studies, 2020, 18(4): 333-339.
[11] Voronkova V H, Nikitenko V A, Teslenko T V, et al. Impact of the worldwide trends on the development of the digital economy. Amazonia investiga, 2020, 9(32): 81-90.
[12] Litvinenko V S. Digital economy as a factor in the technological development of the mineral sector. Natural Resources Research, 2020, 29(3): 1521-1541.
[13] Shkarlet S, Dubyna M, Shtyrkhun K, et al. Transformation of the paradigm of the economic entities development in digital economy. WSEAS transactions on environment and development, 2020, 16(8): 413-422.
[14] Mulaydinov F. Digital economy is a guarantee of government and society development. Ilkogretim Online, 2021, 20(3): 1474-1479.
[15] Novikova N V, Strogonova E V. Regional aspects of studying the digital economy in the system of economic growth drivers. Journal of new economy, 2020, 21(2): 76-93.