Multi-level diagnostics of agrarian economy subjects according to the degree of readiness for digital transformations

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Abstract. Although the agricultural sector is one of the most mature sectors in the Republic of Uzbekistan, the share of agriculture in GDP is 27.9%. This indicator proves that one of the key elements of an intensive approach in the field is the problem of digitalization of agriculture.

The purpose of the study is to formulate and implement a strategy for modernization of agriculture in the digital economy, to develop theoretical, methodological and organizational-methodological rules to improve the quality of network management. Based on the purpose of the study, the following tasks were identified: to assess the level of readiness of agrarian economic entities for digital transformation, taking into account the impact of external and internal environment, grouping, quantitative and scoring methods. As a result, DIGITAL-analysis was developed by grouping, quantitative and scoring methods of readiness of greenhouses for digital transformations.

1. Introduction

The aggravation of modern problems caused by the simultaneous impact of global crisis processes, imbalances between the sectors of the domestic economy and the upcoming digital transformation of most spheres of activity, actualizes the search for effective solutions to modernize such a strategically important industry as agriculture. The large-scale use of digital technologies has become a stable trend in the development of agriculture around the world in recent years. At the same time, the elements of the modernization mechanism in the digital economy remain uncertain, its content is unidentified and contradictory, only a set of factors that determine the objective need for modernization remains constant - ensuring the country’s food security [1,2].

In modern conditions, the transition of the economy to a management system based on the use of a large array of data generated by digital technologies requires a significant revision of targets, principles, mechanisms and tools for modernization, since the current practice for its implementation...
does not allow for a technological breakthrough in the industry. The rapid and widespread introduction of digital technologies, as a basic regularity of the functioning of economic systems in modern conditions, requires a conceptual and methodological substantiation of the process of modernization, taking into account the peculiarities of the transition to the digital economy, including by identifying the degree of readiness of agribusiness entities and the system of industry management for digital transformation.

Over the past five years, under the influence of geopolitical factors, the agro-industrial complex has become a driver of the domestic economy, while not being a high-tech industry and not showing a significant increase in labor productivity and efficiency. The need to attract specialists with new digital competencies into the industry is becoming more and more obvious, the deficit of which is acutely felt in the domestic labor market [3,4].

The digital inequality of territories, manifested in unequal access to digital infrastructure, does not allow the use of a uniform standard set of measures for different regions and territorial entities [5].

These provisions cause a contradiction between the existing concepts, approaches and tools for modernizing agriculture, on the one hand, and the objective disadvantages of their use in the digital economy, on the other. In most modern studies in the field of agricultural modernization, attention was mainly focused on technical and technological modernization and updating the material and material base of production, and the problem of the transition to the use of digital technologies remains isolated and studied fragmentarily [6]. The scientific and practical need for a theoretical, methodological and organizational and methodological substantiation of the formation of a strategy for the modernization of agriculture in the digital economy and the corresponding mechanisms and tools for its implementation have determined the relevance of this problem.

2. Problem statement
For the purpose of conducting multi-level diagnostics of the readiness of the subjects of the agrarian economy for digital transformations, it is necessary to apply the tools of the evaluation and analytical block of the methodology developed earlier in the study for the implementation of the model of agricultural modernization in the context of the transition to the digital economy. To do this, it is necessary to implement the following sequence of analytical actions [7]: 1. Evaluate the subjects of the agrarian economy according to the degree of readiness for digital transformations, taking into account the impact of the external and internal environment using the DIGITAL analysis method, the use of which makes it possible to form a unique DIGITAL profile of the enterprise (scoring and quantitative methods). 2. Assess the digital potential of the regions using the functional capabilities of DIGITAL analysis in order to rank regions into four groups: - progressive level of development of the digital economy - characterizes the absence of signs of digital inequality between territories; - the average level of development of the digital economy - characterizes the subtle signs of digital inequality; - the inert level of development of the digital economy - characterizes the average signs of digital inequality; - depressed regions with a critically low level of development of the digital economy - characterizes acutely tangible signs of digital inequality. 3. Analyze the strengths and weaknesses of the model region's economy, as well as the opportunities and threats for significant transformations in the digital economy. 4. Assess the risks of digitalization of agricultural organizations, identifying the relative impact of the consequences of potential impacts of groups of political, economic, socio-cultural, technological, legal, environmental factors (PESTLE analysis). 5. Evaluate the existing retrospective experience of modernization, ranking municipalities according to the quality of management: the most effective, satisfactory, borderline, unsatisfactory, extremely unsatisfactory. 6.

3. The method of the research
To identify the territories of the Fergana Valley with a high, potential and insufficient degree of readiness for the implementation of the model of transitive modernization in agriculture [8]. Following this algorithm, at the first stage, it is necessary to assess the readiness of agricultural organizations for modernization in the context of the transition to a digital economy using the DIGITAL analysis
method. The objects of analysis were selected two companies Samarkand oblast "Green capital" and Syrdarya region JV "Beck cluster ", which are one of the largest agricultural producers. As a result, the study was set DIGITAL-profile companies, which shows the level of digitization for each analytical unit (Table 1.).

Table 1. Results of scoring DIGITAL-analysis.

| Analytical area                      | Samarkand region "Green capital" LLC | Syrdarya region JV LLC "Bek cluster" |
|--------------------------------------|--------------------------------------|--------------------------------------|
|                                      | Score | Level | Score | Level |
| D - deficits                         | 5.5   | Average | 6.0   | Intensive |
| I - innovation in agriculture        | 3.0   | Average | 4.0   | Intensive |
| G - land, biological resources, climate | 2.5   | Extensive | 6.0   | Average |
| I - infrastructure                   | 3.5   | Average | 4.5   | Intensive |
| T - technique, technology            | 1.5   | Extensive | 2.5   | Average |
| A - administrative processes         | 2.5   | Extensive | 3.0   | Average |
| L - system of legislation and regulation of processes | 1.0   | Extensive | 2.0   | Average |
| final grade                          | 19.5  | Average | 28.0  | Average |

It should be noted that, in general, the digital profile of the JV Bek cluster LLC in the Syrdarya region shows a more intensive type of digital modernization than the Green capital LLC Samarkand region (Figure 1.). The most developed analytical units in the «Bek cluster» JV LLC are - D, I, I, which indicates the absence of deficiencies that directly affect the modernization of production, a high state of innovation at the enterprise and a developed level of digital infrastructure. In turn, the average level is noted for the following analytical blocks - G, T, A, L (Figure 2.).

The application of the obtained data in practice makes it possible to identify the most relevant areas of digital modernization of agriculture through the development of strong, intensively developing areas and leveling the backlog of less developed ones. These analysis results are not conclusive as they are based on a scoring method. It is advisable to use this type of analysis for making operational decisions. In turn, a quantitative analysis of the
development parameters of an economic entity is more relevant for making strategic decisions (Table 2).

This type of analytical actions allows you to determine the level of digitalization both in general and in the context of individual analytical blocks and to establish a DIGITAL profile of agricultural organizations. Depending on the number of points, the final digital profile is established, in which the extensive level is diagnosed in the range from 0 to 17 points, the average - 17–27 points, the intensive - more than 27 points.

As a result of the quantitative DIGITAL analysis, we established a digital profile of the analyzed enterprises (Table 2.), which clearly shows the imbalance of the measures taken to digitally transform production and administrative and management processes in these organizations. An intensive level of development was achieved only in one parameter - administrative processes (Syrdarya region JV LLC "Bek cluster").

In Samarkand region LLC "Green capital" 7 parameters out of 15 have an average level of development, 8 - extensive, in turn, in Syrdarya region JV LLC "Bek cluster": 4 - intensive, 3 - medium, 8 - extensive.

4. Solution of the problem
Leveling areas with an extensive level of development will allow enterprises to reach a higher level of digitalization.

Next, let's move on to the next analytical block of DIGITAL analysis, which is carried out at the regional level. Methodological support is proposed to be built on the basis of individual elements of the "Pattern" method, which will identify asymmetry in the digital development of the regions of the Fergana Valley of the district and will indicate the presence of regional competitive advantages for the introduction of digital technologies. Such an analysis is carried out in relation to the economy as a whole, and not to individual sectors, since at this stage it is important to establish the general level of digitalization of the economy and the development of digital culture, which is expressed in systematic management decision-making based on the collection of a large amount of data using computer technology [9,10]. An important aspect of the study at this stage is also to identify the degree of digital inequality between different regions.

Table 2. Results of quantitative DIGITAL analysis

| Analytical area                        | Thresholds | Analysis result |
|----------------------------------------|------------|----------------|
|                                        | Level      | Samarkand region LLC "Green capital" | Syrdarya region JV LLC "Bek cluster" |
|                                        | Intensive  | Average | Extensive | Meaning | Level | Score | Know reading | Level | Score |
| Intensity of spending on digital technologies (financial deficit),% | 8 | 5-8 | 5 | 2,03 | Extensive | 1 | 3.15 | Extensive | 1 |
| Hiring qualified personnel (personnel shortage),% | 2 | 1-2 | 1 | 0.3 | Extensive | 1 | 0.2 | Extensive | 1 |
| Investment in digital technologies, % | 20 | 10-20 | 10 | 12 | Average | 2 | 17 | Average | 2 |
In the course of the research, we selected the most relevant indicators to assess the level of digitalization in the region (Tables 1–2). All indicators are divided into seven analytical blocks, in the context of which DIGITAL analysis is carried out. The first block "D - deficits" has a specific feature, it contains indicators reflecting obvious shortcomings in the digital transformation system of the region, these are either high tariffs for the Internet and other means of communication, or the share of organizations using the Internet with a low data transfer rate, or insufficient availability of information and communication services [11]. The high value of these indicators is characterized by the presence of deficits in the development of the digital economy at the regional level. The rest of the indicators are assessed as regional advantages.
5. Results

Thus, when calculating the integral value of the DIGITAL analysis, the indicators of the "D - deficits" block should be subtracted from the total score. Note that in the first group of indicators, the Fergana Valley, which dominates in other indicators, has quite significant deficits in the development of the digital economy. So, in the Fergana Valley, the highest tariff for providing a subscriber line to a subscriber for permanent use, regardless of its type (174 thousand UZB per month, with an average republican indicator of 190.48 thousand UZB per month), as well as a tariff for one minute of local telephone connection with a time-based payment system (0.56 thousand UZB per minute, while the average for the Republic of Karakalpak is 0.5, the average republican level is 0.57) (Table 3.36). In general, it should be noted that the affordability of information and communication technology services in the Republic of Karakalpak is higher than the national average.

Hereinafter, X1 - the share of the population that has the opportunity to receive one television program of terrestrial digital terrestrial television broadcasting (data of the Ministry of Telecom and Mass Communications of Uzbekistan at the end of the year; as a percentage of the total population); X2 - tariff for providing a subscriber line for permanent use, regardless of its type, month (at the end of the period, thousand UZB); X3 - subscription fee for Internet access, rubles / month; X4 - provision of a local connection (conversation) via cellular communication, minute (at the end of the period, thousand UZB); X5 - tariff for one minute of local telephone connection with a time-based payment system, minute (at the end of the period, thousand UZB); X6 - the share of organizations using Internet access with a speed of less than 2 Mbit / s, in the total number of organizations,%; X7 is the resource base for R&D and innovation. Share of internal costs for research and development, in% of the gross regional product (GRP); X 8 - institutional environment. The number of researchers who carried out research and development, per 10,000 employed in the economy, people; X 9 - the share of costs for research and development aimed at economic development, in% of the total volume of internal costs for research and development, %; X 10 - the effectiveness of R&D and innovation. The number of patents for inventions issued by UZBpatent to Uzbek applicants, per 1 million people of the population, pieces; X 11 - the share of organizations that received orders for manufactured goods (work, services) via the Internet, in the total number of surveyed organizations,%; X 12 - the share of organizations that placed orders for goods (work, services) on the Internet, in the total number of surveyed organizations,%.  

As for innovations, here the Republic of Karakalpak is significantly inferior to the average republican indicators.

At the same time, the Fergana Valley occupies a leading position in terms of indicators such as the share of expenditures on research and development aimed at developing the economy, in the total volume of internal expenditures on research and development, the share of organizations that received orders for manufactured goods (works, services) via the Internet, in the total number of surveyed organisations. 

| Region                  | D - deficits | I - innovation |
|-------------------------|--------------|----------------|
|                         | X1  X 2  X 3 | X 4  X 5  X 6  X 7  X 8  X 9  X 10  X 11 |
| Tashkent region         | 41.2 190.48 | 571.48 1.39 0.57 58.4 1.36 450.4 39.8 143.2 20.1 41.2 |
| Region "VOXA"           | 32.4 158.06 | 560.3 1.25 0.5 50.1 0.25 11.7 38.4 47.6 13.4 32.4 |
| Republic of Karakalpak  | 18.1 . . . . | 661.6 1.88 . . 51 . . 10.7 . 32 . 46 . 5.7 18.1 |
| Bukhara region          | 33.8 140 1000 | 2.86 0.24 54.2 0.11 9.3 9.6 - 15.3 33.8 |
| Jizzakh region          | 27.9 163 491.23 | 1.13 0.48 56.1 0.47 17.9 10.3 71.6 11.9 27.9 |
| Navoi region            | 38.4 163 498.53 | 1.54 0.48 52.9 0.68 17 3.1 17.2 15.6 38.4 |
| Samarkand region        | 32.7 163 572.08 | 1.58 0.48 49.1 0.27 11.4 29.7 126.8 11.6 32.7 |
| Syrdarya region         | 22.4 . . . . | 1930.56 1.08 0.22 29.6 0.15 6.9 32.8 11.8 5 22.4 |
| Fergana valleys         | 50.2 174 408.52 | 0.95 0.56 57.6 0.28 12.6 64.5 53.9 24.7 50.2 |
| Ximax                   | 18.1 140 408.52 | 0.95 0.22 29.6 0.68 17.9 64.5 126.8 24.7 50.2 |

| Region | D - deficits | I - innovation |
|--------|--------------|----------------|
|        | X 1  X 2  X 3 | X 4  X 5  X 6  X 7  X 8  X 9  X 10  X 11 |
|        |               |                |

X7 is the resource base for R&D and innovation. Share of internal costs for research and development, in% of the gross regional product (GRP); X 8 - institutional environment. The number of researchers who carried out research and development, per 10,000 employed in the economy, people; X 9 - the share of costs for research and development aimed at economic development, in% of the total volume of internal costs for research and development, %; X 10 - the effectiveness of R&D and innovation. The number of patents for inventions issued by UZBpatent to Uzbek applicants, per 1 million people of the population, pieces; X 11 - the share of organizations that received orders for manufactured goods (work, services) via the Internet, in the total number of surveyed organizations,%; X 12 - the share of organizations that placed orders for goods (work, services) on the Internet, in the total number of surveyed organizations,%.
organizations and the share of organizations that placed orders for goods (work, services) on the Internet in the total number of surveyed organizations. In terms of three more indicators, the region under study is in third place [12].

In the block of indicators "G - land resources, climate and biological resources", the dominance of the region is even more obvious. A relatively low value of the indicator is observed only in relation to the share of organizations that have implemented innovations that improve environmental safety in the production of goods, works, services and reduce carbon dioxide (CO2) emissions into the atmosphere, including with the use of digital technologies [13,14].

In this block of indicators, there is also a significant lag of the regions of the Republic of Karakalpak from the average Republican levels. Only the Fergana Valley shows an excess of the average indicators (for nine indicators), the rest of the regions lag significantly behind. This, to some extent, confirms the leading role of the Fergana Valley in the development of digital technologies in the entire macro region [15].

6. Conclusions and recommendations
In the block of administrative indicators, the Fergana Valley leads only in two indicators, which indicates the need to improve the efficiency of sectoral and regional management in providing financial and methodological assistance to the real sector of the economy for the transition to digital technologies. In other regions, the opposite situation is observed, when the region is doing a lot for digital transformation, but the insufficient level of economic development does not allow for a full-fledged transition to digital technologies.

Thus, the generally accepted opinion about the complexity of the financial situation and the unwillingness of agricultural producers to invest in modernization is not confirmed by the results of our research. There is a unanimous opinion of the respondents about the low efficiency of state support for the agricultural sector of the economy, an acute shortage of financial resources and a lack of qualified personnel. The practical application of a matrix of factors of limiting and stimulating influence, differentiated by the nature of the impact of organizational and economic regulators on the introduction of digital technologies in agriculture, will allow for a more balanced policy in the period of transition to the digital economy.

References
[1] Kupriyanova M, Dronov V and Gordova T 2019 Digital divide of rural territories in Russia Agris On-Line Papers in Economics and Informatics 11(3) 85–90 https://doi.org/10.7160/aol.2019.110308
[2] Munawaruzaman A 2020 Implementation of Digital Transformation of the Ministry of Agraria to Improve Public Services Prosiding Senantias 1(1) 589–598
[3] Ulezko A, Reimer V and Ulezko O 2019 Theoretical and methodological aspects of digitalization in agriculture IOP Conference Series: Earth and Environmental Science 274 https://doi.org/10.1088/1755-1315/274/1/012062
[4] Ilchenko T V 2020 The Role of Marketing Instruments in the Innovative Development of Agrarian Enterprises Business Inform 10 (513) 460–468 https://doi.org/10.32983/2222-4459-2020-10-460-468
[5] Ulezko A, Reimer V and Ulezko O 2019 Theoretical and methodological aspects of digitalization in agriculture IOP Conference Series: Earth and Environmental Science 274 https://doi.org/10.1088/1755-1315/274/1/012062
[6] Eisend M 2019 Explaining digital piracy: A meta-analysis Information Systems Research, 30(2), 636–664 https://doi.org/10.1287/isre.2018.0821
[7] Durmanov A, Kalinin N, Stoyka A, Yanishevksa K and Shapovalova I 2020 Features of application of innovative development strategies in international enterprise International Journal of Entrepreneurship 24(1 Special Issue) 1–9
[8] Tkachenko S, Berezovska L, Protas O, Parashchenko L and Durmanov A 2019 Social partnership of services sector professionals in the entrepreneurship education Journal of Entrepreneurship Education 22(4)

[9] Khaustova Y, Durmanov A, Dubinina M, Yurchenko O and Cherkesova E 2020 Quality of strategic business management in the aspect of growing the role of intellectual capital Academy of strategic management journal 19(5) 1–7

[10] Durmanov A, Umarov S, Rakhimova K, Khodjimukhamedova S, Akhmedov A and Mirzayev S 2021 Development of the organizational and economic mechanisms of greenhouse industry in the Republic of Uzbekistan Journal of Environmental Management and Tourism 12(2) 331–340 https://doi.org/10.14505/jemt.v12.2(50).03

[11] Umarov S R. Durmanov A S., Kilicheva F B, Murodov S M O and Sattorov O B 2019 Greenhouse vegetable market development based on the supply chain strategy in the Republic of Uzbekistan International Journal of Supply Chain Management 8(5) 864–874.

[12] Durmanov A, Tulaboev A, Li M, Maksumkhanova A, Saidmurodzoda M and Khafizov O 2019 Game theory and its application in agriculture (greenhouse complexes) In International Conference on Information Science and Communications Technologies: Applications, Trends and Opportunities, ICISCT 2019. Institute of Electrical and Electronics Engineers Inc https://doi.org/10.1109/ICISCT47635.2019.9011995

[13] Durmanov A, Li M, Khafizov O, Maksumkhanova A, Kilicheva F and Jahongir R 2019 Simulation modeling, analysis and performance assessment In International Conference on Information Science and Communications Technologies: Applications, Trends and Opportunities, ICISCT 2019. Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.1109/ICISCT47635.2019.9011977

[14] Durmanov A, Bayjanov S, Khodjimukhamedova S, Nurimbetov T, Eshev A and Shanasirova N 2020 Issues of accounting for organizational and economic mechanisms in greenhouse activities Journal of Advanced Research in Dynamical and Control Systems 12(7 Special Issue) 114–126 https://doi.org/10.5373/1JARDCSV12SP7/20202089

[15] Nurimbetov T, Umarov S, Khafizova Z, Bayjanov S, Nazarbaev O, Mirkurbanova R and Durmanov A 2021 Optimization of the main parameters of the support-lump-breaking coil Eastern-European Journal of Enterprise Technologies 2 (1–110) 27–36 https://doi.org/10.15587/1729-4061.2021.229184