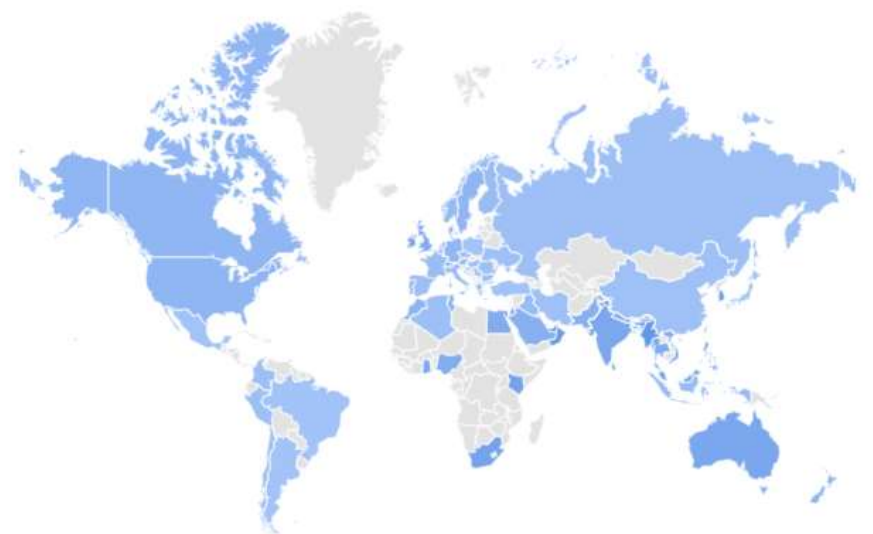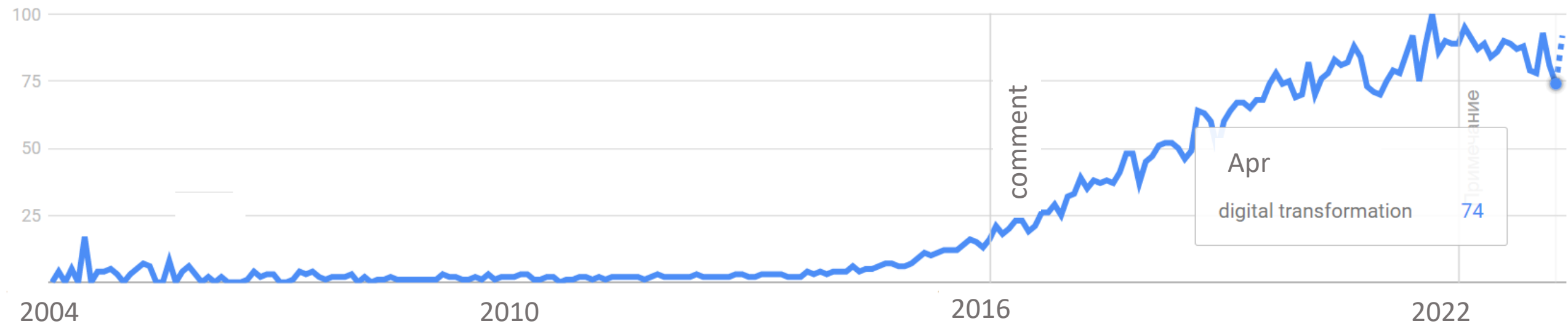CED-2023

Models of identification and forecasting of the country's digitalization state

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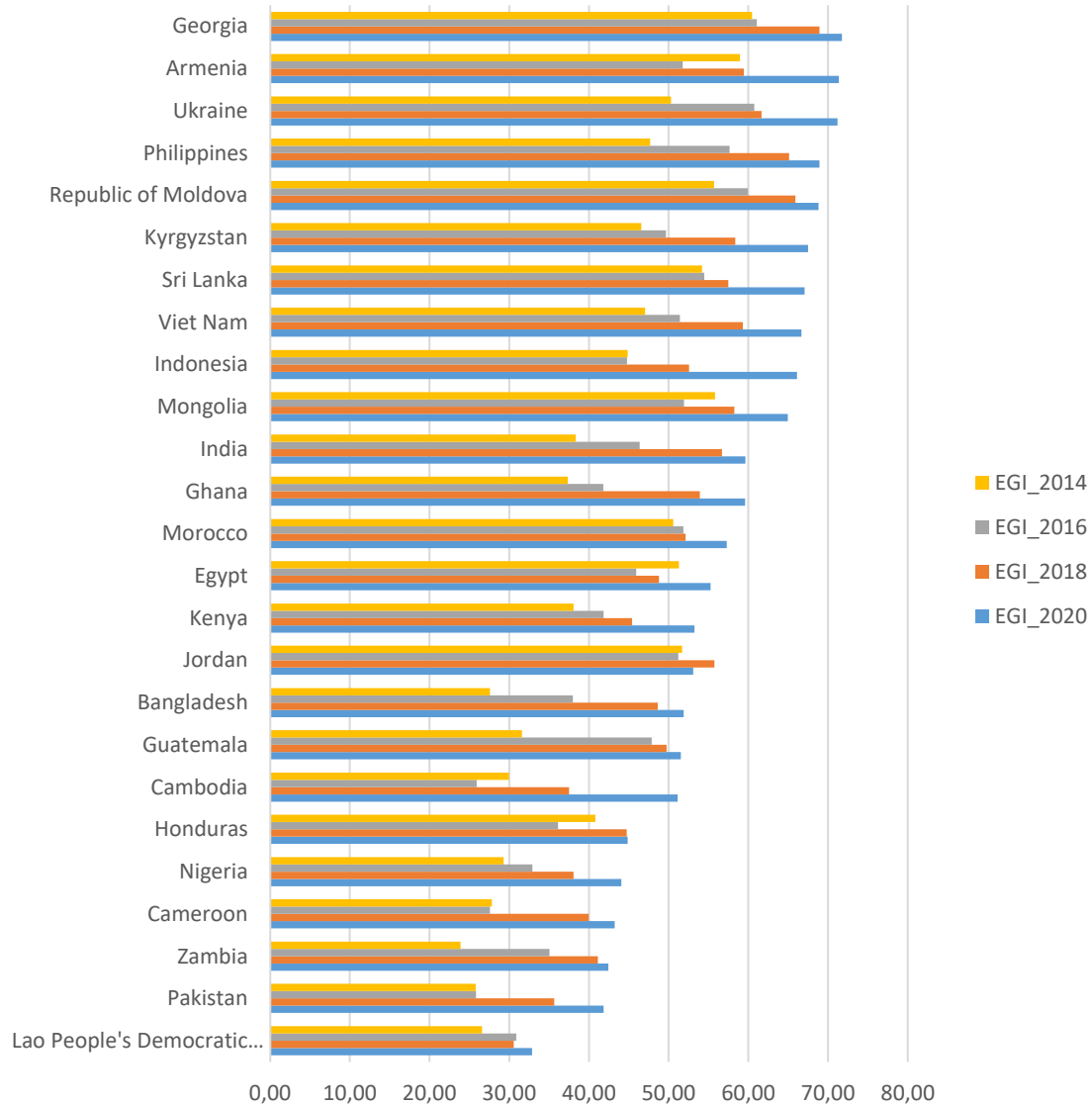Simon Kuznets KhNEU

Fig. 1. Requests popularity dynamics

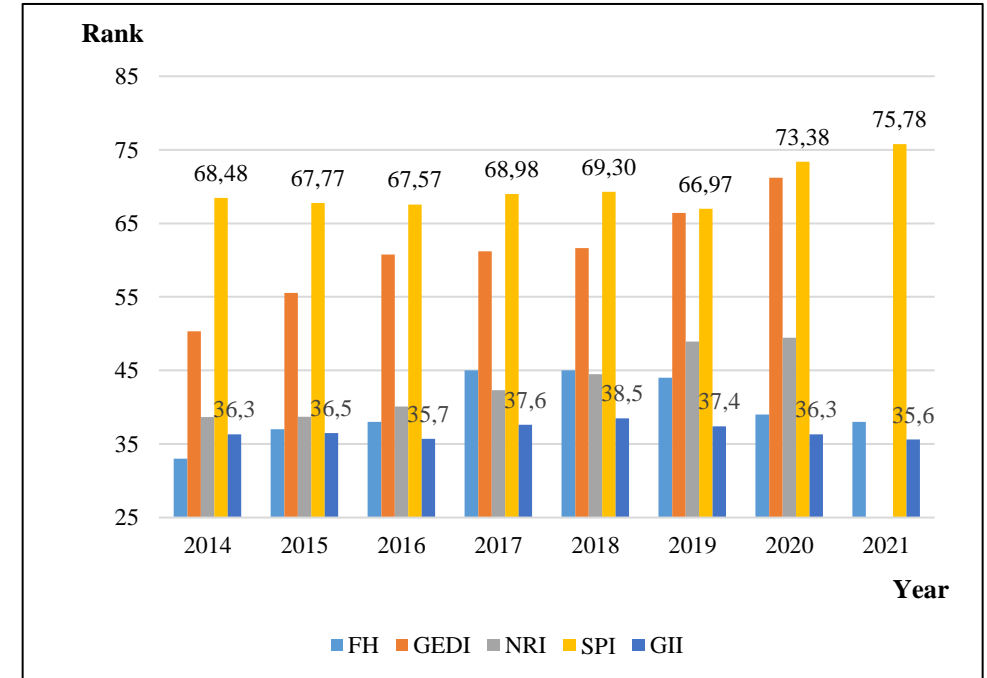Fig 2. Ukraine's rank among countries by the GEDI index

Fig 3. Global indexes characterizing Ukraine's place in international rankings

Assumptions, object and subject:

The purpose of the investigation: developing complex of mathematical models for assessing and analyzing the state of digitization of the country by the methods of intellectual analysis of multidimensional objects. The complex allows to improve the quality of the decision-making on digitalization in the most important sectors of the Ukrainian economy.

The following **tasks** were solved:

consider the essence of digitization of the economy and analyze the current conditions of digital transformation;

carry out an analysis of modern methods and models of digitalization assessment of the country;

to develop models of classification and forecasting of the country's digitization by the multidimensional analysis and Data Science and to position Ukraine among the countries of the world;

The **object of the research** is the processes of digitalization of the country's economy.

The **subject of the research** is a set of mathematical methods for assessing the state of digitization of the state.

Step 1. Construction of the matrix of DDC indicators

Step 2. Standardizing of indexes

Step 3. Calculation of distances matrixes

Step 4. Determination of nearest cases

Step 5. Construction clusters

Step 6. Obtain of cluster's number

Step 7. Construction centroids

Step 8. Verification of the cluster's cases

Fig. 4. Algorithm for assessing of the country's digital
development state

Group of digital state indexes:
$x_1(NRI)$ – The Networked Readiness Index,
x_2 – E-Government Development Index, (The ICT Development Index),
$x_3(FH)$ – Freedom House Index.

Group of social-economic development indexes:
x_4 (GII)– Global Innovation Index,
$x_5(GCI)$ – Global Competitiveness Index
$x_6(SPI)$ – Social Progress Index.
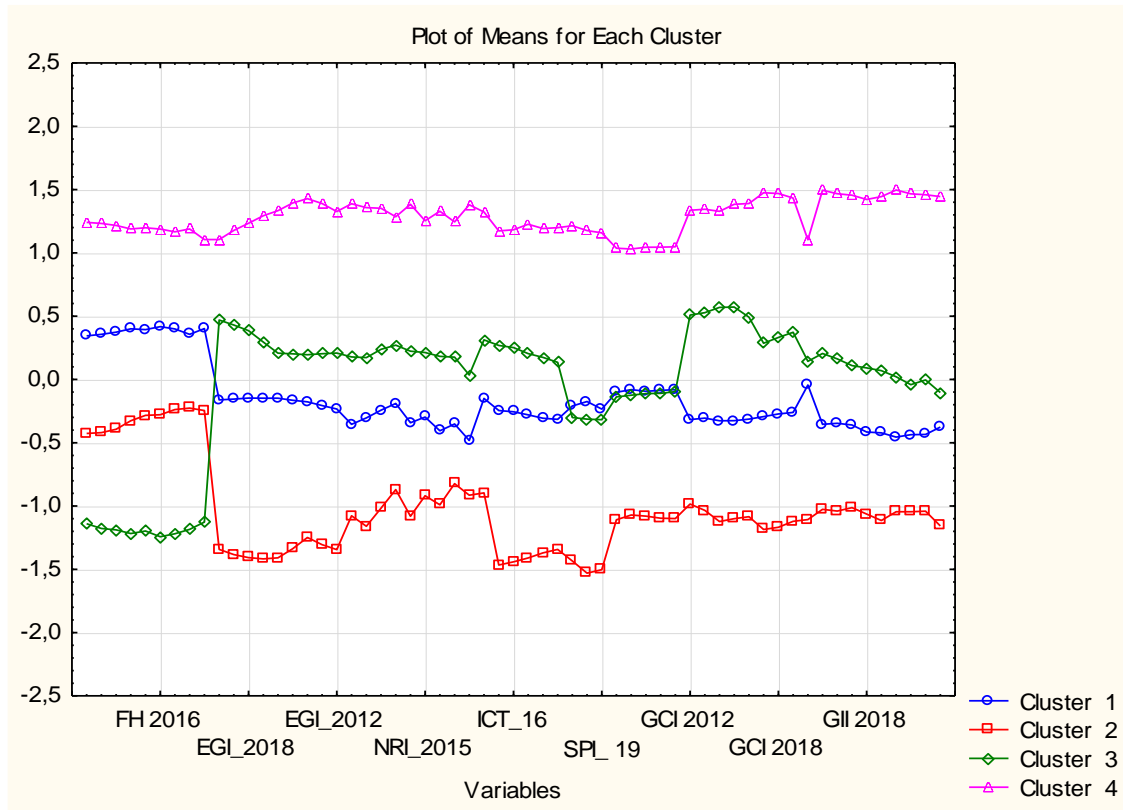
Fig. 5. Grafs of spatial k-means

Variable	Between SS	df	Within SS	df	F	signif. p
FH 2019	35,03483	3	15,41476	47	35,6074	0,000000
EGI_201 9	41,34993	3	6,46904	47	100,1409	0,000000
NRI_19	41,08989	3	5,54979	47	115,9940	0,000000
SPI_19	41,58541	3	4,86877	47	133,8129	0,000000
GCI 2019	43,12793	3	8,55691	47	78,9621	0,000000
GII 2019	40,19963	3	7,94543	47	79,2650	0,000000

Table header: Analysis of Variance (данные страны все стандарт)
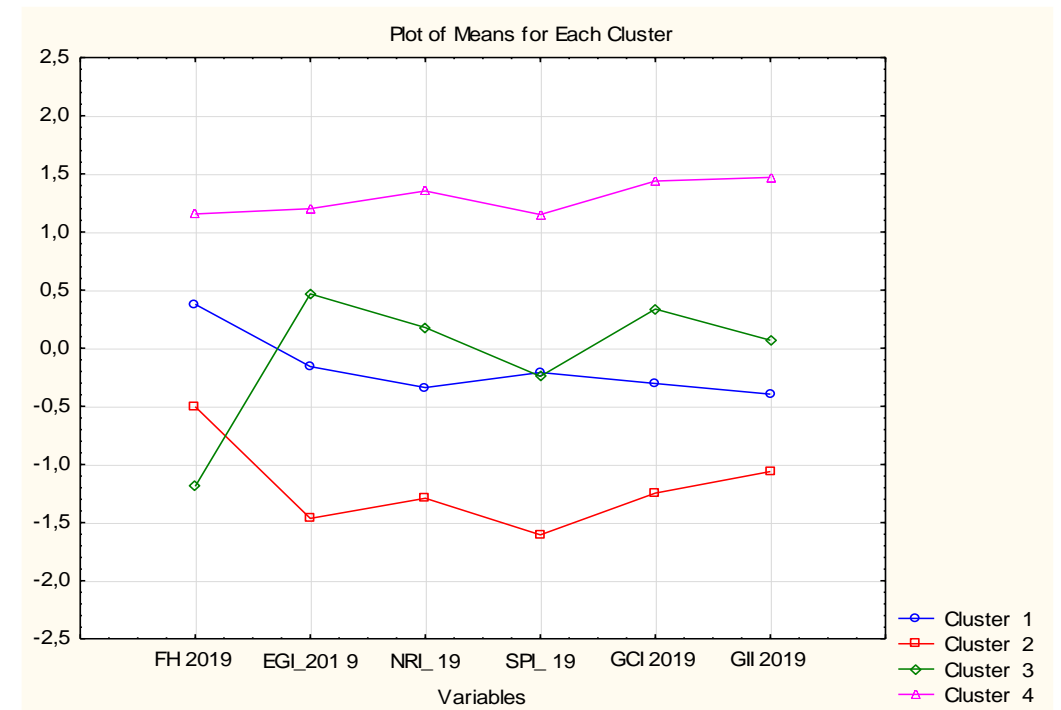
Fig. 6. Analysis of Variance

Fig. 7. Grafs of k-means

Findings

Decision rules of DDC:

if $x_1(NRI) \leq 59{,}245 \cap x_6(GCI) \leq 52{,}41$ then

4 cluster – low state DDC;

if $\{x_1(NRI) \leq 59{,}245 \cap x_6(GCI) > 52{,}41 \cap$

$x_4(FH) \leq 42\} \cup \{x_1(NRI) > 59{,}245 \cap$

$x_7(SPI) > 73{,}78\}$ then 2 cluster – middle state

DDC;

if $x_1(NRI) > 59{,}245 \cap x_6(GCI) > 52{,}41 \cap$

$x_4(FH) > 42 \implies$ then 3 cluster – DDC under middle;

if $x_1(NRI) > 59{,}245 \cap x_7(SPI) > 73{,}78$ then
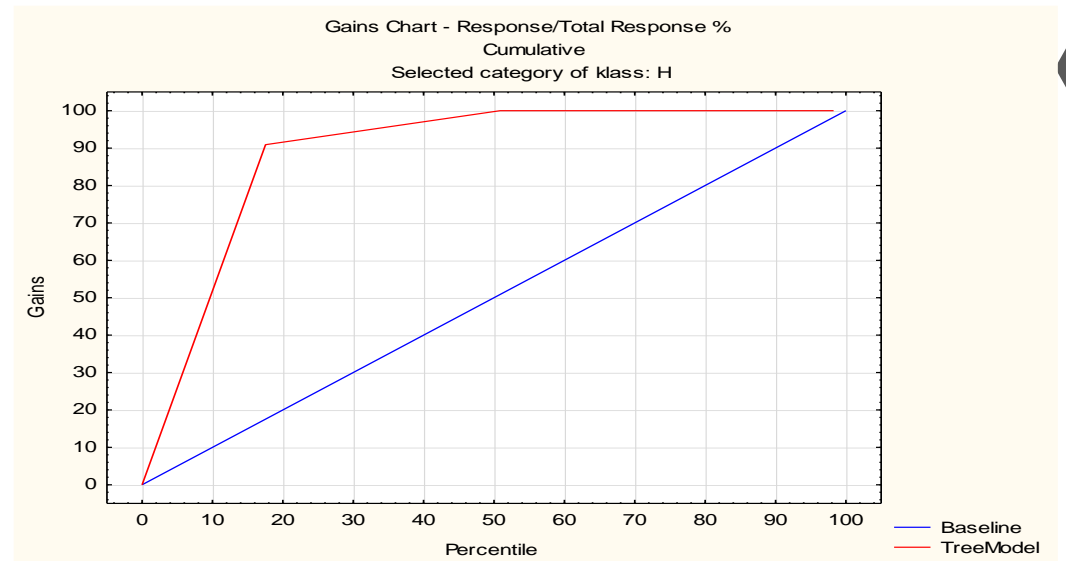
1 cluster – high state DDC.
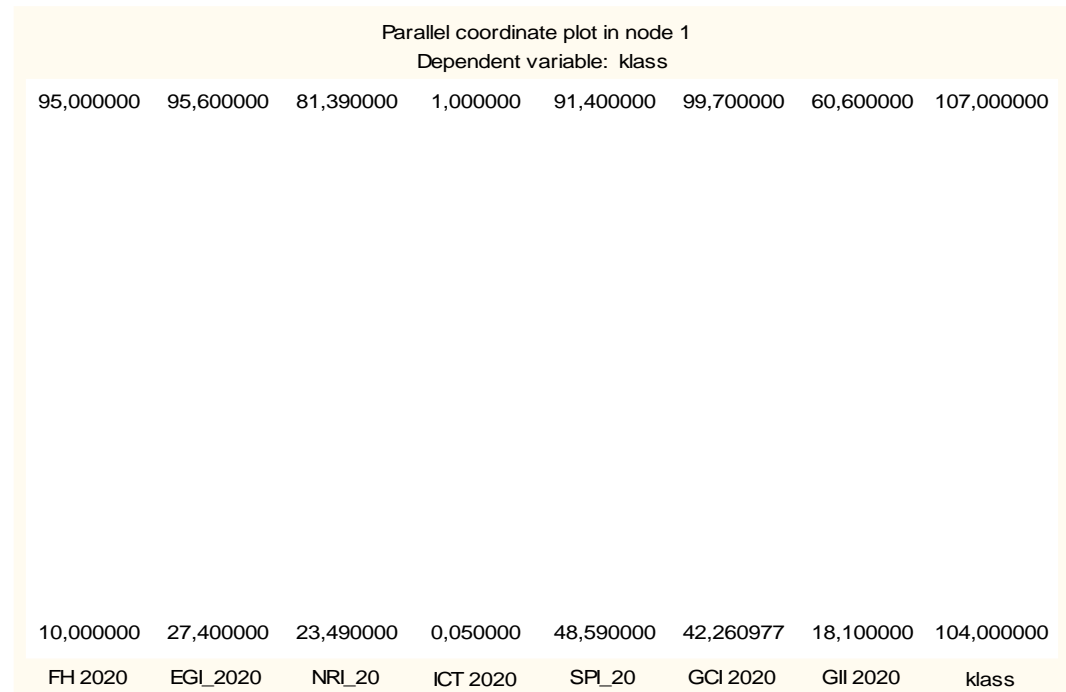

Fig. 8. Gains chart

Fig. 9. Coordinates of the tree

Conclusions

1. The relevance of the DDC investigation and the factors affecting it is explained by the fact that the digital transformation takes place in the conditions of the latest technological order, which is characterized by the development of the knowledge economy, the globalization of the market of digital technologies and information products and services. The transition to a new paradigm of the economy requires an in-depth study of new management methods and justification of economic decisions on digitalization.

2. The analysis of modern approaches, methods and models for assessing the state of digitization of the country allowed us to a conclusion about the inconsistency of opinions and differences in approaches. There are the set of approaches, but the disadvantages of them are subjective due to the assessing the level and state of digitization by expert methods. Formalized models have contradictions regarding the input set of indicators for assessing the state of digitization, which makes unification of such models impossible.

3. Models of classification and forecasting of the state of country's digitization in the global space were developed. The model of the grouping of countries made it possible to identify the state of digital development of Ukraine, to determine the rules for recognizing the state of digital development of the country, which is a prerequisite for developing an IT strategy for digitalization management and identifying possible threats to the country's national security.

The obtained results can be used during the development of strategies for the digital development of the country and its regions, conducting IT audits of management facilities of digitalization.

THANK YOU FOR ATTENTION!