

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

SIMON KUZNETS KHARKIV NATIONAL UNIVERSITY OF ECONOMICS

**ANTI-CRISIS FINANCIAL DECISION
SUPPORT SYSTEMS**

**Guidelines to individual work
for Master's (second) degree students of speciality
072 "Finance, Banking and Insurance"**

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The main issues of the topics which are studied according to the plan of lectures on the academic discipline, individual tasks and guidelines to them are provided. Case tasks for individual work, tests, questions for self-assessment and topics for writing essays are offered.

For Master's (second) degree students of speciality 072 "Finance, Banking and Insurance".

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General information

Independent work is a form of organising students' individual study of educational material in extracurricular time. It plays an important role in the educational process, increases the responsibility of students, develops their skills to work independently, allows them to more effectively activate cognitive and professional motives, and develop creative thinking.

In order to master the material of the academic discipline, in addition to lectures, practical (seminar) classes, i.e. classroom work, considerable attention should be paid to independent work. This is due to the variety of approaches used in modern domestic and foreign practice to the analysis of the activities of enterprises in the process of rehabilitation and to conducting legislative procedures for bankruptcy and financial rehabilitation of business entities and, accordingly, the student's need to familiarise themselves with these approaches.

In addition, lectures are provided for all topics covered by the curriculum. However, some issues included in the content of the academic discipline are covered in a rather brief and overview manner at lectures, seminars and practical classes or are not covered at all, and therefore require a more detailed and in-depth study.

The student's independent work includes:

studying the lecture material;

processing and studying the recommended literature and additional literary sources on the main terms and concepts on the topics of the academic discipline;

analytical review of scientific publications;

study of legislative, regulatory and instructional materials on the regulation of financial rehabilitation and bankruptcy of enterprises;

study of analytical and statistical sources of the Internet;

preparation for practical and seminar classes;

preparation for control measures;

systematisation of the material studied in order to prepare for the semester assessment.

Content module 1. Theoretical and methodological principles of using anti-crisis financial decision support systems

Case study on theme 1. The fundamentals of crisis financial management and modelling its business processes

Topic. Analysis of the development of crisis phenomena in the Ukrainian economy.

This case involves analysis of the macroeconomic situation in Ukraine taking into account its peculiarities that indicate the presence and development of crisis phenomena in the Ukrainian economy.

Guidelines

The student needs to conduct a study of statistical data on the main macroeconomic indicators, the dynamics of which can illustrate the manifestations of the economic crisis. Such indicators may include GDP, inflation, industrial production indices, investment, the real wage index, and others. Particular attention should be paid to indicators that directly characterize crisis phenomena in the economy as a whole and in certain regions or industries (e.g., the number and structure of unprofitable enterprises according to the type of economic and industrial activity, the number of bankruptcy cases filed against enterprises, the structure of decision-making in bankruptcy cases, etc.) The dynamics of the selected indicators may be considered in any context: for Ukraine as a whole, in regional aspects, in the context of certain industries and individual sectors. All statistical data must be referenced!

The information base for the study can be:

the official website of the State Statistics Service of Ukraine [6];

the official website of the National Bank of Ukraine [9];

the official website of the World Bank Doing Business project, etc.

Based on the presented statistical data, the student must conduct a sufficiently deep and thorough analysis, based on which conclusions are drawn about the presence and depth of the crisis in the Ukrainian economy. The result of the case is a presentation of the results of the research.

A checklist for self-assessment

1. Define the concept of financial crisis of an enterprise.
2. What parameters characterise the financial crisis at an enterprise?
3. Identify the main factors that can lead to the development of a financial crisis at an enterprise. Describe them.
4. Describe the types of enterprise crises.
5. What is the main purpose of crisis financial management?
6. Provide a definition of rehabilitation. What are its distinctive characteristics as a tool for crisis financial management?
7. In what cases is the decision to conduct financial rehabilitation made?
8. Describe the types of rehabilitation measures.
9. Explain the relationship between the types, forms and other classification characteristics of rehabilitation.
10. Explain the content of the classical model of rehabilitation.
11. What do you know about modern approaches to financial rehabilitation of enterprises?

References: [5; 14 – 16; 18; 22].

Test tasks for self-testing

Test 1. The main factors that cause a strategic crisis at an enterprise include the following:

- a) deficits in the organisational structure;
- b) unsatisfactory capital structure;
- c) excessive production capacities;
- d) unsatisfactory work with creditors;
- e) low level of quality control.

Test 2. Enterprise rehabilitation is:

- a) provision of external financial assistance to the enterprise;
- b) satisfaction of creditors' claims and fulfilment of obligations to the budget;
- c) a set of all measures that can lead an enterprise to financial recovery;
- d) the same as restructuring;
- e) a system of financial measures.

Test 3. Financial rehabilitation measures include:

- a) refinancing of receivables;
- b) appointment of a temporary administration;

- c) implementation of a social plan;
- d) debt restructuring;
- e) technical re-equipment of production.

Test 4. The functional tasks of rehabilitation management include:

- a) conducting a rehabilitation audit;
- b) organizing the implementation of the rehabilitation project;
- c) development of the rehabilitation concept;
- d) search for development alternatives;
- e) organisation of control over the implementation of the rehabilitation project.

Test 5. The model of enterprise rehabilitation includes:

- a) cause and effect analysis of the financial crisis;
- b) declaring an enterprise bankrupt;
- c) development of a rehabilitation strategy;
- d) the decision of the arbitration court on the rehabilitation;
- e) entry into the register of insolvent enterprises.

Case study on theme 2. Technologies and systems of intellectual processing of statistical financial information and diagnostics of financial crises

Topic. Evaluation of an enterprise from the point of view of insolvency and signs of bankruptcy.

To complete the case, it is necessary, based on the financial statements of the business entity selected for analysis (Balance Sheet and Income Statement), to calculate the indicators that make it possible to identify signs of fictitious and premeditated bankruptcy. To do this, use [3]. The student can choose any business entity as an object of research, whose reports are presented on the Internet portal [11] or are available to the graduate student.

The assessment of the enterprise from the point of view of insolvency and the presence of signs of bankruptcy is carried out in 3 stages.

1. Assessment of the financial condition of the company. Assessment of changes in the financial condition of the company in previous years is necessary to form a general idea and general trends in its development.

Based on the results of the analysis of indicators, a conclusion is drawn about the direction of changes and their impact on the company's solvency.

Based on the results of the calculation of the indicators in Tables 1 and 2. Table 3 is filled in and the analysis of changes (by comparing the calculated indicators with the optimal values) and the state of solvency of the enterprise for the period under analysis is carried out.

Table 1

A list of indicators, used in the in-depth analysis of the financial and economic condition of insolvent enterprises

Indicator name	Source of information	
1	2	3
Assets	form No. 1	line 1300 (or line 1900)
Assets at the beginning of the period	form No. 1	line 1300 (1900), column 3
Assets at the end of the period	form No. 1	line 1300 (1900), column 4
Equity	form No. 1	line 1495
Net working capital	form No. 1	line 1495 – line 1095 or line 1195 – (line 1595 + line 1695)
Fixed assets (residual value)	form No. 1	line 1010
Cash and cash equivalents	form No. 1	line 1165 + line 1160
Long-term debt	form No. 1	line 1595
Stocks	form No. 1	line 1100
Depreciation of fixed assets (beginning, end of the period)	form No. 1	line 1012, column 3 or column 4
Deferred income	form No. 1	line 1665
Short-term investments	form No. 1	line 1160
Current liabilities	form No. 1	line 1695
Long-term financial investments	form No. 1	line 1030
Other long-term financial investments	form No. 1	line 1035
Non-current assets	form No. 1	line 1095
Current assets	form No. 1	line 1195
"Normal" sources of cover	form No. 1	line 1495 – line 1425 – line 1430 + + line 1595 – line 1095 + line 1600 + + line 1605 + line 1610 + line 1620 + + line 1625
Cost of fixed assets (beginning, end of the period)	form No. 1	line 1011, column 3 or column 4
Deferred expenses	form No. 1	line 1170
Cost of fixed assets at the end of the period	form No. 1	line 1011, column 4
Cost of fixed assets at the beginning of the period	form No. 1	line 1011, column 3

Table 1 (the end)

1	2	3
Borrowed capital (long-term and current liabilities)	form No. 1	line 1595 + line 1695
Average cost of equity	form No. 1	line 1495 (column 3 + column 4) / 2
Average receivables	form No. 1	lines 1130, 1135, 1140, 1145, 1155 (column 3 + column 4) / 2
Average stocks	form No. 1	line 1100 (column 3 + column 4) / 2
Average payables	form No. 1	line 1600 + line 1605 + line 1610 + + line 1620 + line 1625 (column 3 + + column 4) / 2
Net working capital	form No. 1	line 1195 – line 1695
Net sales (revenue)	form No. 2	line 2000
Operation expenses	form No. 2	line 2050 + line 2130 + line 2150 + + line 2180
Gross profit (loss)	form No. 2	line 2090
Cost of goods sold	form No. 2	line 2050
Administrative expenses	form No. 2	line 2130
Sales expenses	form No. 2	line 2150
Pretax income	form No. 2	line 2190 or line 2195, column 3
Net profit (loss)	form No. 2	line 2350 or line 2355
Depreciation as an element of operating expenses	form No. 2	line 2515

2. Analysing the presence (absence) of signs of fictitious, concealed bankruptcy or bringing the company to bankruptcy.

2.1. Identification of signs of fictitious bankruptcy.

A bankruptcy may be declared fictitious if the debtor company (if it has the capacity to do so) has not satisfied its creditors' claims and budgetary obligations in full at the time it files a petition for recognition of insolvency with the commercial court.

In order to draw the appropriate conclusion, it is necessary to determine the coverage ratio by comparing the size of the company's current assets with its long-term and current liabilities. In this case, long-term and current liabilities should include both the principal amount of the debt and interest, fines, penalties and forfeitures in respect of this debt, if they are specified in accounting standards or there is a court decision on their recovery. If a company's coverage ratio exceeded one with zero or positive profitability, this may indicate signs of fictitious bankruptcy at the company.

A system of indicators for assessing the financial position of an enterprise

Key indicators describing the aspects of the activity monitored, unit of measurement	The procedure for calculating analytical indicators	Conclusions
1	2	3
Liquidity assessment		
Absolute liquidity (solvency) ratio (Ca1)	$\frac{\text{cash and cash equivalents} + \text{short-term investments}}{\text{current liabilities}}$	Shows what part of the short-term liabilities can be repaid immediately, the most stringent liquidity criterion, the limit value is 0.1 – 0.2
Current (total) liquidity ratio	$\frac{\text{current assets} + \text{deferred expenses}}{\text{current liabilities}}$	The value depends on industries and types of activities, its growth is regarded as a favourable trend, the threshold value is 1.5
Quick liquidity ratio	$\frac{\text{current assets} - \text{stocks} - \text{deferred expenses}}{\text{current liabilities}}$	When analysing the trend of changes in this indicator, attention should be paid to the factors that caused its change
Manoeuvrability of own current assets	$\frac{\text{current assets}}{\text{net working capital}}$	For the normal functioning of the enterprise, this indicator varies from 0 to 1
Inventory coverage ratio	$\frac{\text{"normal" sources of cover}}{\text{stocks}}$	If the value of this indicator is less than 1, the current financial position of the company is considered to be unstable
Financial autonomy ratio	$\frac{\text{equity}}{\text{assets}}$	The critical value is 0.5; an increase in the value of this indicator or an increase in the indicator signals the termination of the company's financial dependence on borrowed funds
Financial sustainability assessment		
Equity capital concentration ratio	$\frac{\text{equity}}{\text{assets}}$	The growth of this indicator means an increase in the financial strength, stability and independence of the enterprise

Table 2 (the continuation)

1	2	3
Leverage ratio of the debt capital structure	$\frac{\text{long-term debt}}{\text{borrowed capital (long-term and current liabilities)}}$	Shows what part of the enterprise's borrowed capital is made up of long-term liabilities
Debt capital concentration ratio	$\frac{\text{borrowed capital (long-term and current liabilities)}}{\text{assets}}$	Shows what part of the enterprise's balance sheet is borrowed capital
Long-term investment structure ratio	$\frac{\text{long-term debt}}{\text{non-current assets}}$	Shows what part of fixed assets and other non-current assets is financed by external investors. An increase in the value of the indicator in the dynamics shows an increase in the enterprise's dependence on external investors
Financial dependency ratio	$\frac{\text{assets}}{\text{equity} + \text{deferred income}}$	An increase in the value of this indicator in the dynamics means an increase in the share of borrowed funds in the financing of the enterprise
Equity manoeuvrability ratio	$\frac{\text{equity} - \text{non-current assets}}{\text{equity}}$	The value of this indicator depends on the capital structure and industry sector of the enterprise. In order to draw a conclusion, it is necessary to compare its value with the industry-wide size
Long-term borrowed funds ratio	$\frac{\text{long-term debt}}{\text{long-term debt} + \text{equity}}$	The growth of this indicator in the dynamics is a negative trend that indicates dependence on external financing
The ratio of borrowed and own funds	$\frac{\text{borrowed capital}}{\text{equity}}$	An increase in this indicator means a decrease in financial stability, and vice versa
Financial leverage ratio	$\frac{\text{equity}}{\text{assets} - \text{equity}}$	A decrease in the value of this indicator shows positive changes at the enterprise
Own funds coverage ratio	$\frac{\text{equity} - \text{non-current assets}}{\text{current assets}}$	The growth of this indicator provides the insolvent enterprise with the possibility of using out-of-court measures to restore solvency; the threshold value is 0.1

Table 2 (the end)

1	2	3
Fixed-assets turnover ratio, UAH/UAH	$\frac{\text{net sales (revenue)}}{\text{average cost of equity}}$	The value of the indicator depends on the industry specifics of the enterprise
Duration of the financial cycle, days	duration of the operating cycle – duration of the operating cycle	A decrease in the value of the indicator is considered a favourable trend for the enterprise
Economic growth sustainability ratio	$\frac{\text{net profit (loss) – dividends}}{\text{assets}}$	Shows the average pace at which the enterprise can develop in the future
Current solvency	long-term financial investments + other long-term financial investments + cash and cash equivalents – – borrowed capital	A negative result indicates the current insolvency of the enterprise
Beaver's ratio	$\frac{\text{net profit (loss) – depreciation}}{\text{borrowed capital}}$	If this indicator does not exceed 0.2, this reflects an undesirable reduction in the share of profit allocated to production development
Profitability assessment		
Product profitability, %	$\frac{\text{gross profit (loss)} \times 100}{\text{cost of goods sold} + \text{administrative expenses} + \text{sales expenses}}$	An increase in profitability is considered a favourable trend for the enterprise
Return on assets, %	$\frac{\text{net income}}{\text{total assets}} \times 100$	
Return on equity, %	$\frac{\text{net income}}{\text{total equity}} \times 100$	

Table 3

**Key indicators determining the financial and economic state
of a company**

No.	Indicators	Actual value for the two previous years			Notes, regulatory value
		20 __	20 __	changes (+ / -)	
1	2	3	4	5	6
1.1. General performance indicators of the company					
1	Net income (revenue) from sales of products (goods, works, services), UAH thousand				
2	Net profit (loss), UAH thousand				
3	Average number of employees, persons				
4	Payroll, UAH thousand				
5	Equity, UAH thousand				
6	Non-current assets, UAH thousand				
7	Long-term liabilities, UAH thousand				
8	Short-term loans and borrowings, UAH thousand				
9	Accounts receivable, UAH thousand				
10	Stocks, UAH thousand				
11	Own current assets, UAH thousand				
12	Working capital, UAH thousand				
13	Labour productivity, UAH thousand / person				
1.2. Liquidity indicators					
14	Current liquidity ratio				1,5
15	Quick liquidity ratio				0.6 – 0.8
16	Absolute liquidity (solvency) ratio				0.2 – 0.35
17	Manoeuvrability of own working capital				0 – 1
18	Inventory coverage ratio				>1
19	Financial autonomy ratio				0.5
1.3. Financial stability indicators					
20	Equity concentration ratio				> 0.5
21	Financial dependency ratio				= 2
22	Equity manoeuvrability ratio				> 0.1
23	Debt capital concentration ratio				< 0.5
24	Long-term investment structure ratio				

Table 3 (the end)

1	2	3	4	5	6
25	Long-term debt ratio				
26	Leverage ratio of the debt capital structure				
27	Debt-to-equity ratio				
28	Equity coverage ratio				0.1
29	Financial leverage ratio				< 0.25
30	Duration of the financial cycle				
31	Current solvency				
32	Beaver's ratio				> 0.2
1.4. Profitability indicators					
33	Product profitability, %				
34	Profitability of core activities, %				
35	Return on total equity, %				

When identifying signs of a fictitious bankruptcy, it is necessary to take into account the existence of an official application of the owner or officer of the debtor company to the commercial court to initiate bankruptcy proceedings against this company, on the basis of which the relevant court decision was made, and the actual possibility of satisfying creditors' claims, including obligations to the budget, in full at the time of applying to the court. In the course of the analysis, it is necessary to fill in Table 4.

Table 4

Analysis of indicators for detecting signs of fictitious bankruptcy

No.	Indicators	Source of information	As at the date of recognition of insolvency	As at the beginning of the period under review	As at the end of the period under review
1	Current assets	form No. 1 line 1195			
2	Current liabilities of the enterprise	form No. 1 line 1695			
3	Coverage ratio	$\frac{\text{current assets}}{\text{borrowed capital}}$			
4	Product profitability	$\frac{\text{gross profit (loss)}}{\text{net sales (revenue)}}$			

2.2. Determining the signs of bankruptcy.

Determination of the signs of bankruptcy can be made when a bankruptcy case has been initiated in court and there are signs of illegal actions of the debtor's responsible persons that have led to its financial insolvency.

Signs of bankruptcy are the actions of the debtor's respective persons that have led to a deterioration in the company's solvency, and as a result, the debtor was unable to satisfy creditors' claims in full or make mandatory payments.

First of all, it is necessary to determine whether the level of collateral for creditors' obligations has changed during the period under review. If such changes have occurred, it is necessary to find out the terms and conditions of the contracts under which these changes occurred.

The level of security for creditors' obligations is characterised by the following indicators:

- collateralisation of the debtor's liabilities with all of its assets (the ratio of the debtor's assets to the amount of its liabilities);

- security of the debtor's liabilities by its current assets (the ratio of current assets to the amount of the debtor's liabilities);

- the amount of net assets (the difference between the sum of the company's assets and its liabilities).

If it has been established that the above indicators have deteriorated during the period under review, it is necessary to find out under which contracts this has occurred. These contracts should be checked for compliance with the market conditions for goods and services (price, sales volume, quality, competitiveness), as well as the favourable terms of the contracts for the debtor.

Based on the results of the analysis of Table 4, Table 5 is filled in.

The economic signs of actions to bring about bankruptcy may be considered such as financial and economic condition of the debtor when the fulfilment of the terms of the contracts has led to a deterioration in the indicators of assessment of its financial condition.

2.3. Identification of signs of concealed bankruptcy.

If at certain stages of the bankruptcy proceedings it is established that the debtor has provided false information about its property in its financial statements or other documents that indicate its financial and property position, in such cases there may be signs of concealed bankruptcy.

Analysis of indicators for detecting signs of bankruptcy

No.	Indicators and their normative values	Source of information (form No. 1)	As at the date of recognition of insolvency	As at the beginning of the period under review	As at the end of the period
1	Securing the debtor's obligations with all his assets (the ratio of the debtor's assets to the amount of his obligations)	line 1300 / / (line 1595 + + line 1695)			
2	Security of the debtor's liabilities by its current assets (the ratio of current assets to the amount of the debtor's liabilities)	line 1195 / / (line 1595 + + line 1695)			
3	The amount of net assets (the difference between the sum of the enterprise assets and its liabilities)	line 1195 – – (line 1595 + + line 1695)			
Analysis of contracts that influenced the change in the above indicators:					
4	The prices specified in the contracts are in line with the general market prices (yes/no)	analytical information			
5	The terms of the contracts are favourable for the enterprise (yes/no)	analytical information			

Signs of concealed bankruptcy include:

providing third parties (banking institutions, government agencies, suppliers, buyers) with knowledge of false information about the financial and economic condition of the company;

the possibility of recognising a causal link between the information provided and the losses suffered by the third party.

The intentional deterioration of the financial and economic condition of a company can be identified by the following main features:

reduction in the size, concealment and understatement of the valuation of property at the disposal of the company;

artificially increasing the amount of accounts payable and receivable;

the company has fines, penalties, forfeitures recognised in court for failure to comply with contractual terms and conditions and non-compliance with legal requirements;

unprofitable operations for two years;

the existence of pending court cases in which the company is a defendant for the last two years;

investments not directed to the company's core business;

the presence of advantages in the structure of the company's income from non-core activities;

deviation of liquidity indicators from the threshold value;

unreasonable reduction of the company's staff.

In the course of the analysis, Table 6 is filled in.

Table 6

Analysis of indicators for detecting signs of concealed bankruptcy

No.	Indicators and their normative values	Source of information	As at the date of recognition of insolvency	As at the beginning of the period under review	As at the end of the period under review
1	2	3	4	5	6
1	Property at the disposal of the enterprise, UAH thousand	form No. 1, line 1300			
2	Accounts receivable, UAH thousand	form No. 1 (line 1125 / / line 1155)			
3	Overdue portion of accounts receivable, %	analytical information			
4	Amount of fines and penalties, UAH thousand	analytical information			

Table 6 (the end)

1	2	3	4	5	6
5	Accounts payable, UAH thousand	form No. 1 line 1595 + + line 1695 + + line 1695			
6	Amount of damage, UAH thousand	form No. 2 line 2355			
7	Number of cases initiated in court (defendant enterprise), pieces	analytical information			
8	Share of income from non-core activities in the company's income structure, %	form No. 2 (line 2200 + + line 2220 + + line 2240) / / line 2290			
9	Absolute liquidity ratio ($K \geq 0.5$)	form No. 1 line 1165 / / line 1695			
10	Current liquidity ratio ($K \geq 2$)	form No. 1 line 1195 / / line 1695			

3. Analysis of the factors that led to insolvency and determination of the feasibility of enterprise rehabilitation.

Based on the results obtained, it is necessary to formulate analytical conclusions. In doing so, attention should be paid to the following:

whether there are signs that could indicate the possibility of a fictitious bankruptcy;

whether there are signs of bringing the company to bankruptcy;

whether there are signs that would allow to assert a concealed bankruptcy of the company.

Draw a general conclusion about the possibility of the enterprise's bankruptcy.

Determine the feasibility of the company's rehabilitation or liquidation.

A checklist for self-assessment

1. Explain the meaning of the concept of rehabilitation strategy and its place in the structure of the overall economic strategy of an enterprise.
2. Describe the functional structure of the rehabilitation strategy.
3. What types of rehabilitation strategy do you know?
4. What is the essence of controlling as a tool of crisis management?
5. Identify the tasks of rehabilitation controlling at an enterprise.
6. Highlight the functions of controlling according to their classification.
7. What is the information support of the controlling system?
8. Describe the relationship between strategic controlling and the formation of the enterprise rehabilitation strategy.
9. Describe budgeting as a tool of operational controlling.
10. Explain the content and stages of building an early warning and response system (EWRS). What tasks is it aimed at?
11. What foreign and domestic models of assessing the probability of bankruptcy of an enterprise do you know? List them.
12. Briefly describe the methods of rehabilitation controlling.
13. Describe the structure of the enterprise rehabilitation plan. On what principles should it be based?
14. Explain and describe the structure of the main part of the rehabilitation plan.
15. Identify the features of the rehabilitation audit. What are its main tasks?
16. Who can be the customers of the rehabilitation audit?
17. Describe the stages of the rehabilitation audit.
18. Explain the concept of rehabilitation capacity of an enterprise.
19. What methods can be used during the rehabilitation audit?
20. Identify areas of analysis of production and economic activity of an enterprise during the rehabilitation audit.
21. What is the audit of the financial sector of an enterprise?
22. How is the information support for the diagnosis of the development of crisis phenomena at an enterprise formed, what is its main source?
23. What methods of selecting indicators for diagnosing signs of crisis at an enterprise do you know?

References: [1 – 3; 6 – 9; 12; 13; 18; 23; 25; 26].

Test tasks for self-testing

Test 1. The early warning and response system includes:

- 1) forecasting possible scenarios of the enterprise's development;
- 2) identification of early warning and response indicators;
- 3) benchmarking;
- 4) formation of information channels;
- 5) financial risk insurance.

Test 2. Main controlling tools are:

- 1) early warning and response system;
- 2) simulation modelling;
- 3) inventory;
- 4) audit;
- 5) financial control.

Test 3. The catalogue of rehabilitation measures under the Crash programme may include:

- 1) refinancing of receivables;
- 2) mobilisation of hidden reserves through the sale of certain asset items;
- 3) making capital investments;
- 4) organisation of rehabilitation controlling;
- 5) leaseback.

Test 4. The main purpose of the rehabilitation audit is as follows:

- 1) determination of the reliability of the company's financial statements, their completeness and compliance with the current legislation;
- 2) forming conclusions about the real financial position of the company;
- 3) assessing the rehabilitation capacity of the company based on the analysis of its financial and economic activities and the existing rehabilitation concept;
- 4) development of the company's rehabilitation concept;
- 5) determining the completeness and correctness of the calculation and payment of tax payments to the budget.

Test 5. The clients of a rehabilitation audit of an enterprise in financial crisis may be:

- 1) a lender (e.g. a banking consortium) – if the issue of granting a rehabilitation loan is being considered;
- 2) the debtor company – if it proposes to enter into an amicable agreement and carry out rehabilitation in the course of bankruptcy proceedings;

3) the State Commission on Securities and Stock Market – in case of issue of securities;

4) a potential rehabilitator – if the issue of rehabilitation of the company is being considered through its reorganisation (merger, acquisition);

5) a consulting firm – in case of development of a rehabilitation plan.

Case study on theme 3. Intelligent forecasting systems in the development of anti-crisis measures

Topic. Assessment of financial balance at an enterprise.

To complete the case, based on the data of Form 1 "Balance Sheet" (Statement of Financial Position) of the chosen enterprise, assess the compliance of the enterprise with the rules of financing, which characterise the degree of its financial balance. The dynamics of the sources of financing used by the enterprise should be investigated and analytical conclusions should be presented.

The golden rule of financing

The essence of the golden rule of financing is the need to match the terms for which financial resources are mobilised with the terms for which they are invested in real or financial investments. The golden rule of financing is also called the golden banking rule, or the rule of coherence (congruence, parallelism) of terms. According to this rule, financial capital should be mobilised for a period not less than the period for which this capital is frozen in the company's non-current and current assets. Compliance with the requirements of the golden rule of financing ensures stable liquidity and solvency for the company. When it is used, the problem arises of comparing individual balance sheet asset and liability items (individual investment objects and sources of financing), since the balance sheet does not directly show which assets are financed by certain liabilities.

The golden rule of financing is expressed by meeting the following two conditions:

$$\frac{\text{Non-current assets}}{\text{Long-term liabilities}} \leq 1. \quad (1)$$

$$\frac{\text{Short-term assets}}{\text{Short-term capital}} \geq 1. \quad (2)$$

It should be noted that, in the opinion of some financiers, if this rule is followed, financial equilibrium is ensured if:

1) the invested capital is released in a timely manner (within the stipulated timeframe) as a result of economic activity;

2) there is a possibility of substitution or prolongation of the terms of capital repayment;

3) payments that are due can be made from operating and investing activities.

Using the balance sheet data and formulas (1), (2), fill in Table 7 and determine whether the enterprise complies with the golden rule of financing. Provide detailed analytical conclusions and recommendations.

Table 7

Assessment of the implementation of the golden rule of financing at an enterprise

Indicator	20__ y.	20__ y.	Deviation
Long-term assets, UAH thousand			
Long-term liabilities, UAH thousand			
Short-term assets, UAH thousand			
Short-term capital, UAH thousand			
$\frac{\text{Long-term assets}}{\text{Long-term liabilities}}$			
$\frac{\text{Short-term assets}}{\text{Short-term capital}}$			
Evaluation of the implementation of the golden rule of financing (implemented / not implemented)			

The golden rule of the balance sheet

The golden rule of the balance sheet is considered as a more specific form of the rule of adequacy of the terms of attraction and use of financial resources of enterprises. In order to achieve parallel timing of the mobilisation and use of financial resources, it requires compliance with certain ratios between certain items of liabilities and assets.

To this end, it is recommended to be guided by the following two conditions when assessing the financial balance of an enterprise:

a) the need for capital to finance non-current assets should be covered by equity and long-term borrowings:

$$\frac{\text{Equity + long-term liabilities}}{\text{Non-current assets}} \geq 1; \quad (3)$$

b) long-term investments should be financed with funds mobilised for a long-term period, i.e. long-term liabilities should be used not only to finance non-current assets, but also for long-term current assets (e.g. working capital advanced for strategic raw materials, illiquid goods, etc.):

$$\frac{\text{Equity + liabilities}}{\text{Non-current assets + Long-term current assets}} \geq 1. \quad (4)$$

The terms of the golden rule of balance are illustrated in Fig. 1.

Using the balance sheet data and formulas (3), (4), fill in Table 8 and determine whether the enterprise complies with the golden rule of the balance sheet. Provide detailed analytical conclusions and recommendations.

Table 8

Assessment of the implementation of the golden rule of the balance sheet at an enterprise

Indicator	20__ y.	20__ y.	Deviation
Equity			
Long-term liabilities			
Non-current assets			
Long-term current assets			
$\frac{\text{Equity + long-term liabilities}}{\text{Non-current assets}}$			
$\frac{\text{Equity + long-term liabilities}}{\text{Non-current assets + long-term current assets}}$			
Assessment of compliance with the golden rule of the balance sheet (complied with / not complied with)			

Non-current assets	Equity
	Long-term liabilities
Current assets	Current liabilities

Non-current assets	Equity
	Long-term liabilities
Long-term current assets	
Current assets	Current liabilities

Fig. 1. **Conditions of the golden rule of balance**

The vertical capital structure rule

The rule of the vertical capital structure is related to the analysis of the composition and structure of sources of capital formation. In this case, there is no linkage to assets, i.e. the areas of use of the company's financial resources. The vertical structure rule requires a certain ratio between the company's equity and debt capital. In this case, it is necessary to calculate the debt ratio and the independence ratio. The former characterises the company's dependence on borrowed capital and is defined as the ratio of borrowed capital to sources of own funds. The higher the value of the independence ratio (K_{avt}), the less risky is the company's capital structure (less dependence on creditors). If the share of equity in the structure of funding sources increases, then $K_{avt} = 1$; if there is a tendency to finance with borrowings, then $K_{avt} = 0$.

There are different views on the capital structure. Some economists believe that the ratio of equity to debt should be 1 : 1. According to this approach, the total amount of debt should not exceed the amount of own sources of financing, i.e. the critical value of $K_{avt} = 0.5$.

Thus, using the balance sheet data, it is necessary to fill in Table 9, calculate the indicators and assess the company's compliance with the rule of vertical capital structure, and then provide and justify detailed analytical conclusions.

Table 9

Calculation of the vertical capital structure indicators

Indicator	Calculation procedure	20__ y.	20__ y.	Deviation
Debt ratio	$\frac{\text{Debt capital}}{\text{Equity}}$			
Independence ratio	$\frac{\text{Equity}}{\text{Capital}}$			
Net debt (net)	Debt capital – – current assets			
Assessment of compliance with the vertical capital structure rule (compliant / not compliant)	–			

Note. Information support for the content and calculation of the indicators presented in Tables 7 – 9 is presented in Table 10.

Table 10

Information support of the indicators used to assess compliance with the rules of enterprise financing

Indicator	Information support, form 1
Long-term assets	line 1095 + line 1200
Long-term liabilities	line 1495 + line 1595 + line 1700
Short-term assets	line 1195
Short-term capital	line 1695
Equity capital	line 1495
Long-term borrowings	line 1595
Non-current assets	line 1095
Long-term current assets	line 1100 + line 1110 + line 1190
Debt capital	line 1595 + line 1695
Current assets	line 1195

A checklist for self-assessment

1. Describe the components of the company's equity capital.
2. What functions does the authorised capital of the enterprise perform?
3. What is the economic content of the balance sheet rehabilitation and the purpose of the rehabilitation profit?
4. When do the prerequisites for reducing the authorised capital of enterprises arise?
5. What are the main objectives of reducing the authorised capital of an enterprise?
6. Describe the methods of reducing the authorised capital.
7. What is the denomination and conversion of shares?
8. Explain the concept of enterprise restructuring.
9. Identify the classification features of restructuring.
10. Briefly describe the types of enterprise restructuring.
11. What is the target orientation of the rehabilitation restructuring?
12. Describe the stages and procedure of restructuring.
13. What are the features of reorganisation aimed at consolidation of enterprises?
14. What are the features of reorganisation aimed at disaggregation of enterprises?
15. Describe the transformation as a special type of reorganisation of enterprises.

Test tasks for self-testing

Test 1. Sanation profit is:

- 1) the projected profit that an enterprise plans to receive after the successful completion of rehabilitation;
- 2) the difference between the costs of rehabilitation and the revenue received after financial recovery;
- 3) the difference between the company's profit after its rehabilitation and the profit (loss) before the rehabilitation measures;
- 4) share premium in the form of a disinvestment;
- 5) profit received by the company as a result of writing off a part of accounts payable.

Test 2. The main purposes of reducing the share capital are as follows:

- 1) obtaining a rehabilitation profit;
- 2) increase of the company's solvency;

- 3) increase of the nominal value of corporate rights;
- 4) increase of the market value of corporate rights;
- 5) balance sheet rehabilitation.

Test 3. A two-stage rehabilitation consists of the following:

- 1) reduction of the authorised capital of the company with its subsequent increase;
- 2) reduction of the nominal value of the charter capital (shares) or non-refundable financial assistance from the owners;
- 3) increase of the authorised capital by increasing the nominal value of shares;
- 4) issue of bonds with their subsequent exchange for ordinary shares;
- 5) a combination of different forms of share capital increase.

Test 4. Alternative rehabilitation involves:

- 1) an alternative choice of financial sources of rehabilitation between own and borrowed funds;
- 2) a combination of reduction and increase of the company's share capital;
- 3) reduction of the nominal value of the authorised capital (shares) or non-refundable financial assistance from the owners;
- 4) issue of conversion loan bonds;
- 5) transformation of debt into property.

Test 5. Financial participation of creditors in the rehabilitation of debtors may take the following forms:

- 1) restructuring of the existing debt;
- 2) alternative rehabilitation;
- 3) debt reduction or write-off;
- 4) provision of rehabilitation loans;
- 5) conversion of property into debt.

References: [1 – 3; 6 – 9; 12; 13; 18; 23; 25; 26].

Case study on theme 4. Information systems to support anti-crisis financial decisions

Topic. Structural and functional modelling of business processes.

To complete the case, you need to create a contextual diagram of the business process and its decomposition (AS-IS and TO-BE for the first and second levels) using the MS Visio software environment.

Guidelines

The modern practice of creating management systems is characterised by several approaches to their organisation. The most well-known of them are systems based on the management of functions and business process management of an organisation.

A business process is a sequence of actions (subprocesses) aimed at obtaining a given result that is of value to the organisation.

Management systems based on the principles of function management represent a hierarchical pyramidal structure of divisions grouped by the functions they perform. A functional unit is a group of experts in a particular functional area.

Another approach to creating management systems is to manage the processes (workflows) that make up the company's operations. The process approach involves a process coordinator (owner) and executors from different functional areas grouped on the principle of unity of the business process result. *The process approach* allows you to consider an enterprise's activities as a connected system of business processes, each of which is interconnected with other business processes or the external environment. The interpretation of the essence of the key elements of the process approach is shown in Table 11. The basic element of the process approach to the analysis and synthesis of an organisation's activities is the concept of *business process*.

A textual or graphical description of a system with a certain level of detail is *a model*. It is an artificial object that represents a reflection (image) of the system and its components.

A system of conventional notation that is acceptable in any field of knowledge or activity is called *notation* (from the Latin *notatio* – recording, designation). A notation consists of a list of symbols (notation alphabet) used to represent concepts and their relationships, and the rules for using them.

Key elements of the process approach

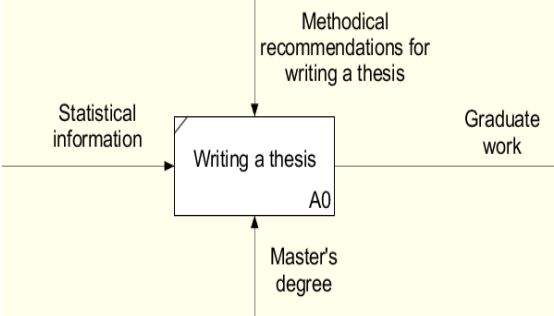
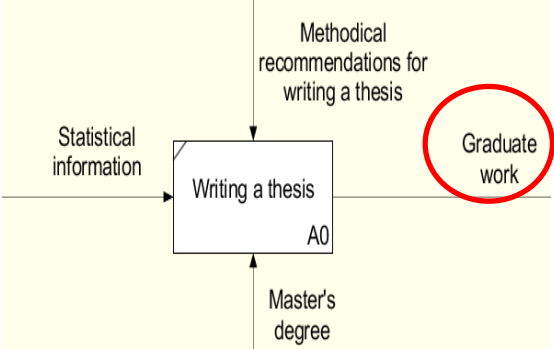
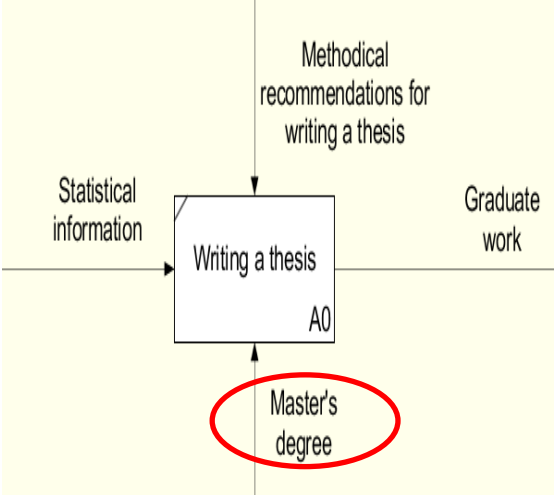
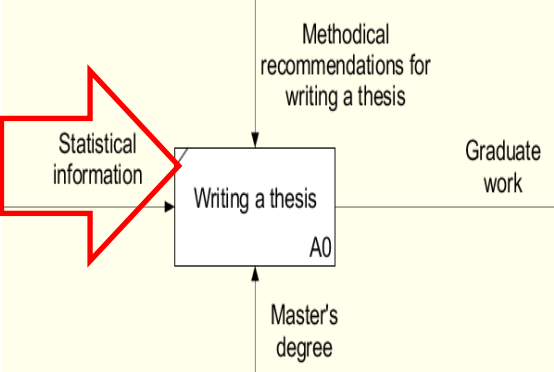
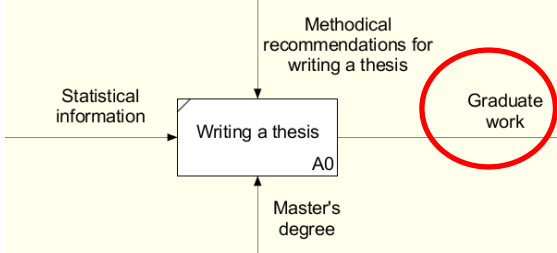
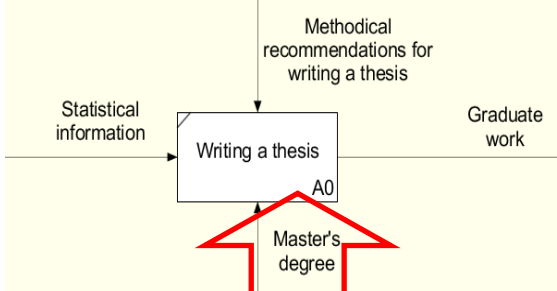
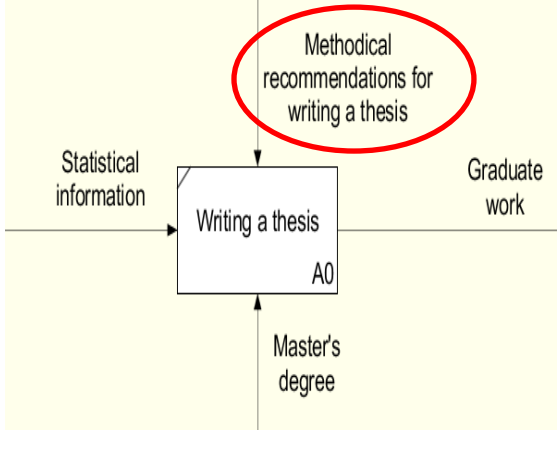
Element	Symbolic designation
1	2
<p>A <i>business process</i> is a purposeful sequence of procedures that is necessary to achieve a given end result. A business process that is an integral part of a higher process is called a <i>subprocess</i>. A <i>procedure</i> is a lower-level business process that contains a sequence of final (not requiring additional detailing of actions) functions</p>	
<p>The <i>result of a business process</i> is what the business process is performed for, i.e. the activity is always considered in conjunction with the purpose of the activity – to obtain some result that satisfies the specified requirements. Business process results are often referred to as business process outputs</p>	
<p>A <i>Business process owner</i> is an official who is responsible for obtaining the process result and has the authority to manage the resources required to perform the process. <i>Business process performers</i> are a team of specialists from different functional areas (cross-functional team) that performs the process actions. Process performers are more result-oriented than performers of individual functions under the functional approach, since the basis of the motivational scheme in process management is the distribution of bonuses among team members only in case of obtaining the final result</p>	
<p><i>Business process inputs</i> are material or informational resources that are required to perform and obtain the result of the process and are consumed or transformed during the process. The inputs are transformed or consumed by the process to create the output</p>	

Table 11 (the end)

1	2
<p><i>Business process outputs</i> are material or informational objects that result from the execution of a business process and are consumed by other business processes or customers external to the organisation. Outputs are data or material objects created by a process</p>	
<p><i>Business process mechanisms</i> are the technological or labour resources used to implement a process that cannot be fully consumed during a single process iteration. Mechanisms identify the means that support the execution of the process</p>	
<p><i>Business process controls</i> are the regulatory or legislative documents or guidelines that regulate the execution of a process. The control defines the conditions required by the process to create the correct output. The principle of distribution of business processes is the main issue faced by the developer of the model. Based on the definition, there is only one principle of process separation – the result. When dividing business processes, it is necessary to ensure that one level of the model contains one-level performance results, and therefore processes</p>	

In order to create a functional model that reflects the structure and functions of the system, as well as the flows of information and material objects that connect these functions, one of the most popular notations is used – the IDEF0 graphical modelling notation. The IDEF modelling standard is based on the SADT (Structured Analysis & Design Technique) methodology.

Procedure

Create a new file in MS Visio. To create a new document, you need to launch MS Visio: START → ALL PROGRAMS → MS OFFICE → VISIO. In the window that opens, select the **IDEF0 diagram** template and click the "**Create**" button (Fig. 2).

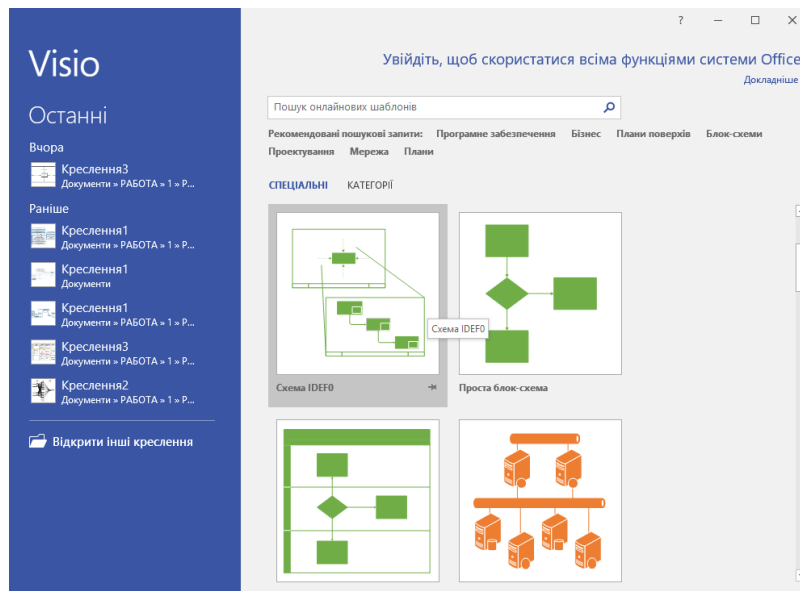


Fig. 2. Creating a new document in MS Visio

After performing the previously mentioned actions, a new document will open (Fig. 3).

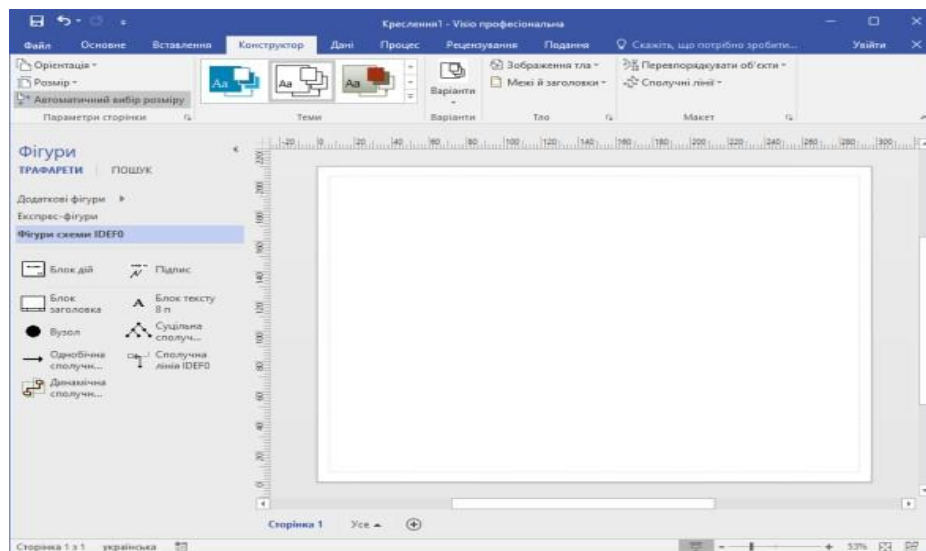


Fig. 3. A new document

Define the heading block. In the left part of the document, select the **Header block** element and drag it to the document sheet (Fig. 4). In the Shape data window, specify the following parameters and click **OK**: **Node** – A-0.

Title – Management ... (the name of the contextual diagram of business processes must correspond to the topic of the Master's thesis).

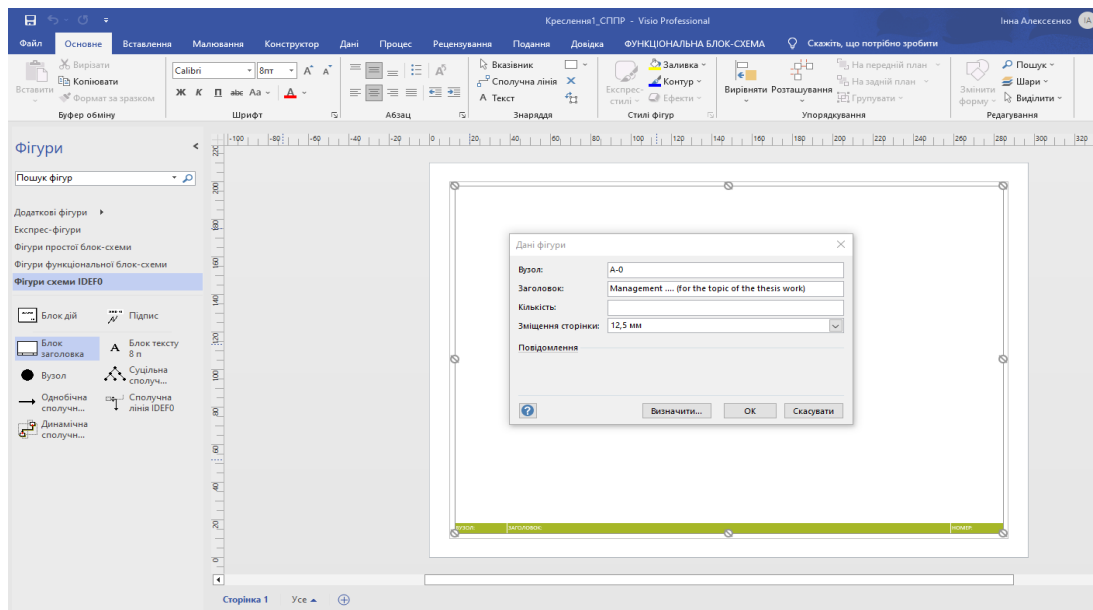


Fig. 4. Setting the project title block

1.1. Create a contextual diagram. On the toolbar of shapes and stencils, select the **Action block** element and drag it to the centre of the diagram. In the Shape Data window, specify the name of the contextual diagram (Fig. 5). After these actions, a rectangle should appear (Fig. 6).

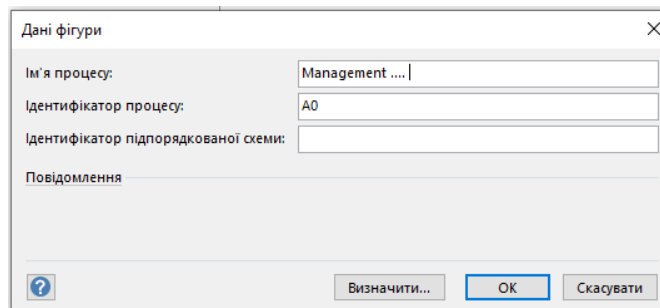


Fig. 5. Entering the name of the contextual diagram

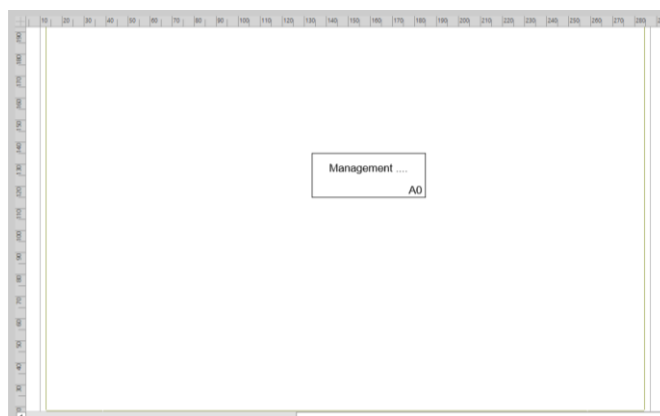


Fig. 6. Creating a contextual diagram

1.2. Create interface arcs (arrows). To create interface arcs (arrows), select the **One-way connecting line** element and drag it onto the document sheet (Fig. 7).

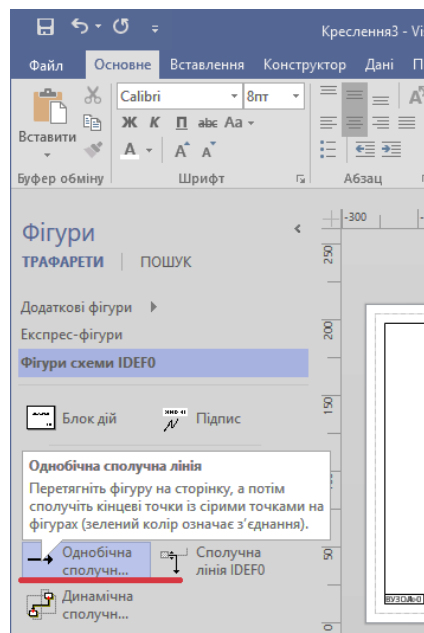


Fig. 7. Creating arrows

To draw incoming arrows, you should bring the beginning of the arrow to the left border of the diagram, and its end should be attached to the left border of the business process (BP) block (Fig. 8). Arrows exiting the block are created in the same way, only the beginning of the arrow should be placed on the right border of the BP block, and then drag the arrow to the right border of the diagram (Fig. 9). The creation of control arrows and mechanisms is shown in Fig. 10 and 11, respectively.

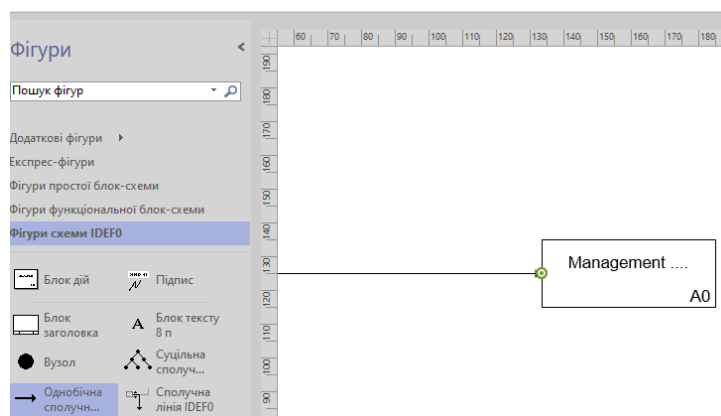


Fig. 8. Creating incoming arrows

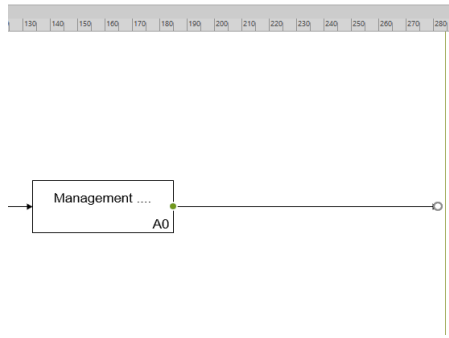


Fig. 9. Output arrows

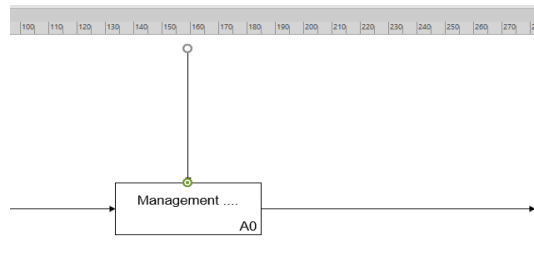


Fig. 10. Control arrows

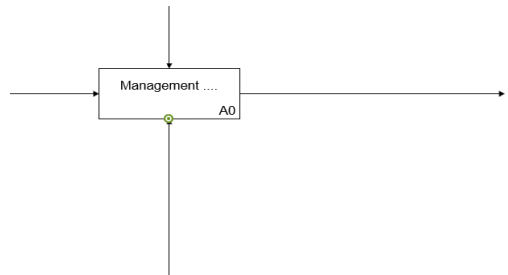


Fig. 11. Arrows of the mechanisms

To name (rename) an arrow, move the cursor over it and click on it twice (Fig. 12 and 13).

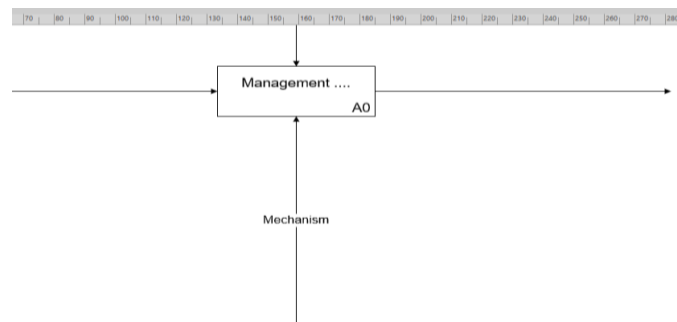


Fig. 12. Renaming an arrow

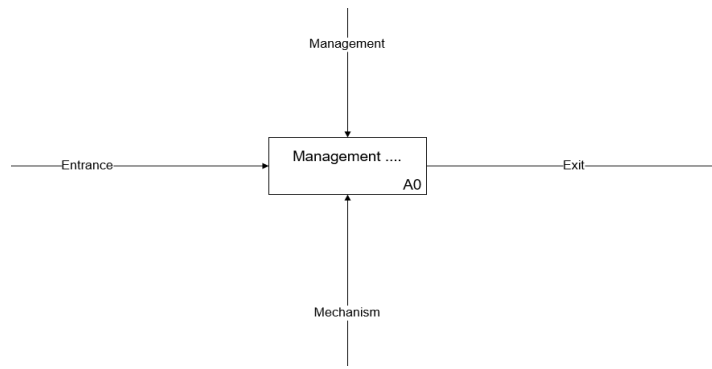


Fig. 13. **Business process and its interface arcs**

Other objects can be named in a similar way. The finished context diagram is shown in Fig. 14.

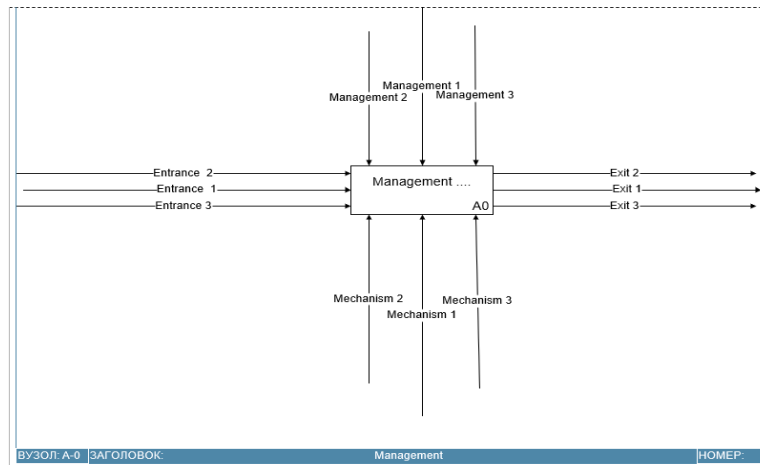


Fig. 14. **The context diagram**

1.3. Decomposition of the context diagram. To decompose the context diagram (break it down and move to a lower level of processes), click "Create a new document sheet" (Fig. 15).

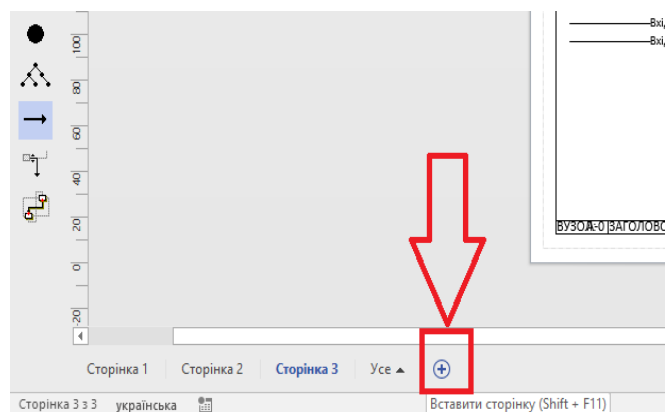


Fig. 15. **Decomposition of the context diagram**

Drag the Header block element onto the created email (as was done in section 1.2). The block properties should be filled in as shown in Fig. 16.

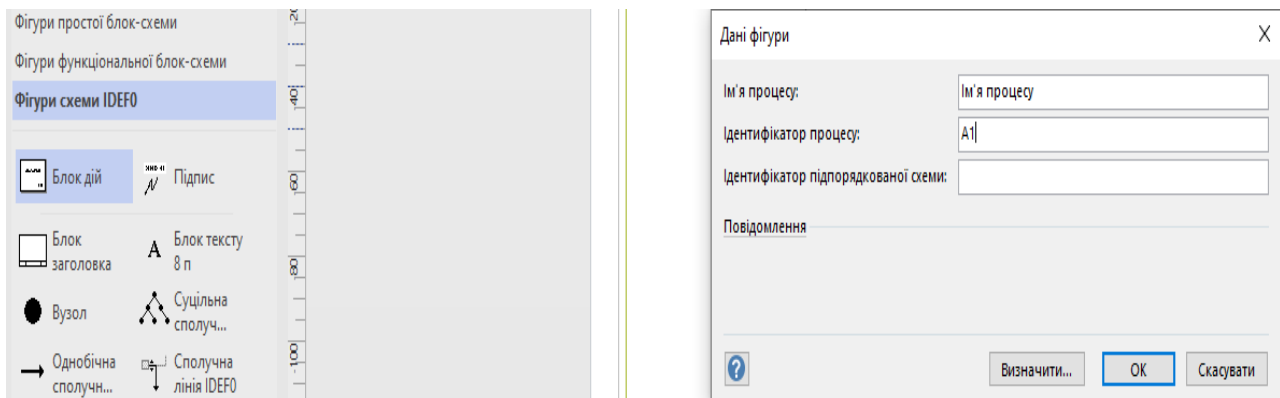


Fig. 16. Defining the properties of the decomposition diagram

After performing these actions, a blank document sheet for building a child chart will appear on the screen. You should drag the required number of elements of **the Action block** and interface arrows to the diagram page (Fig. 16).

Attach arrows for inputs, outputs, mechanisms, and controls to the business process blocks. All used elements in the diagram should be renamed and connected to each other in a logical sequence. To rename the blocks (business process) and arrows, double-click on them and enter the name.

To create an automatic transition to the page with the decomposition from the context diagram, you should return to the sheet of the latter. First, you need to select the business process block, then go to the **Project** section of the MS Visio toolbar and in the Subprocess section, click the **Link to Existing** button (Fig. 17). In the drop-down list, specify the page number of the file that will contain the decomposition diagram.

The finished diagram will look like the one shown in Fig. 18. To move between the diagrams of the upper and lower levels, use the arrows on the toolbar or project tabs (Fig. 19).

To move between related diagrams of the model, press the Ctrl button on the keyboard and left-click on the business process whose decomposition you want to switch to.

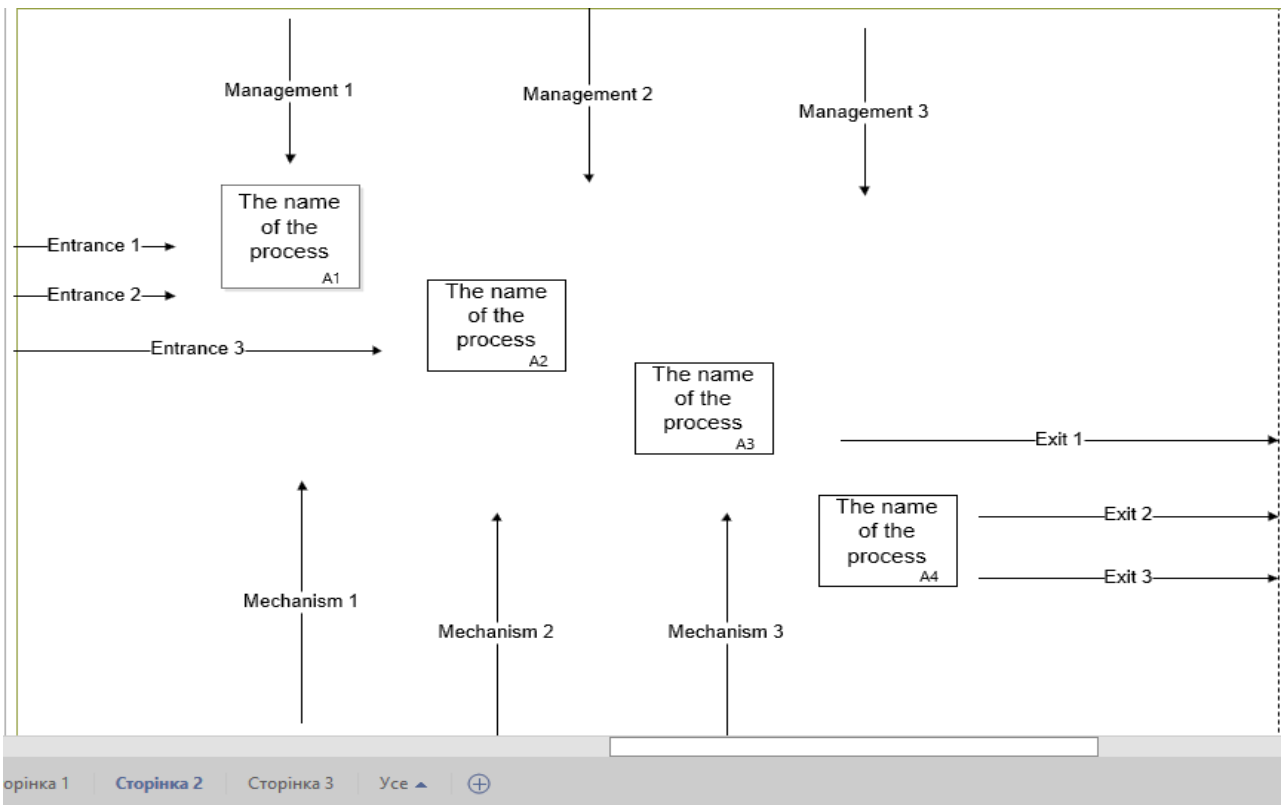


Fig. 17. Creating elements of a decomposition diagram

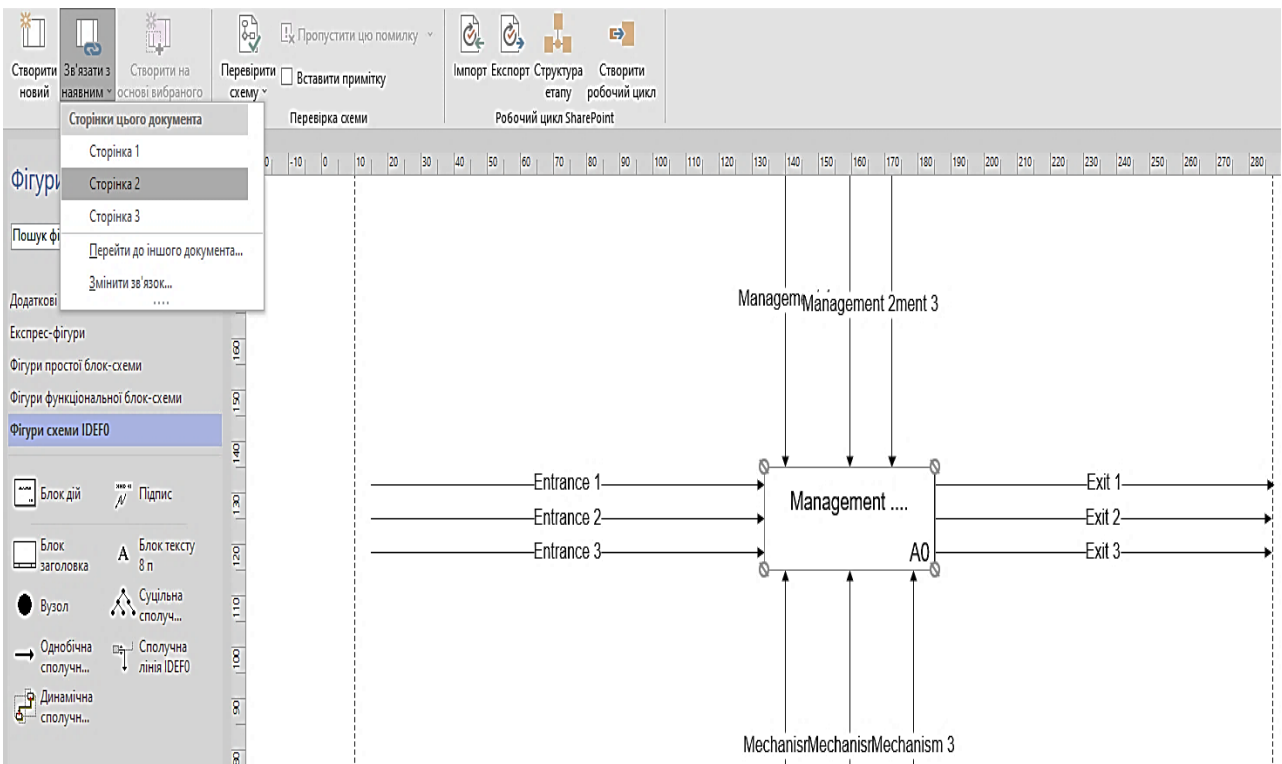


Fig. 18. Creating an automatic transition between model diagrams

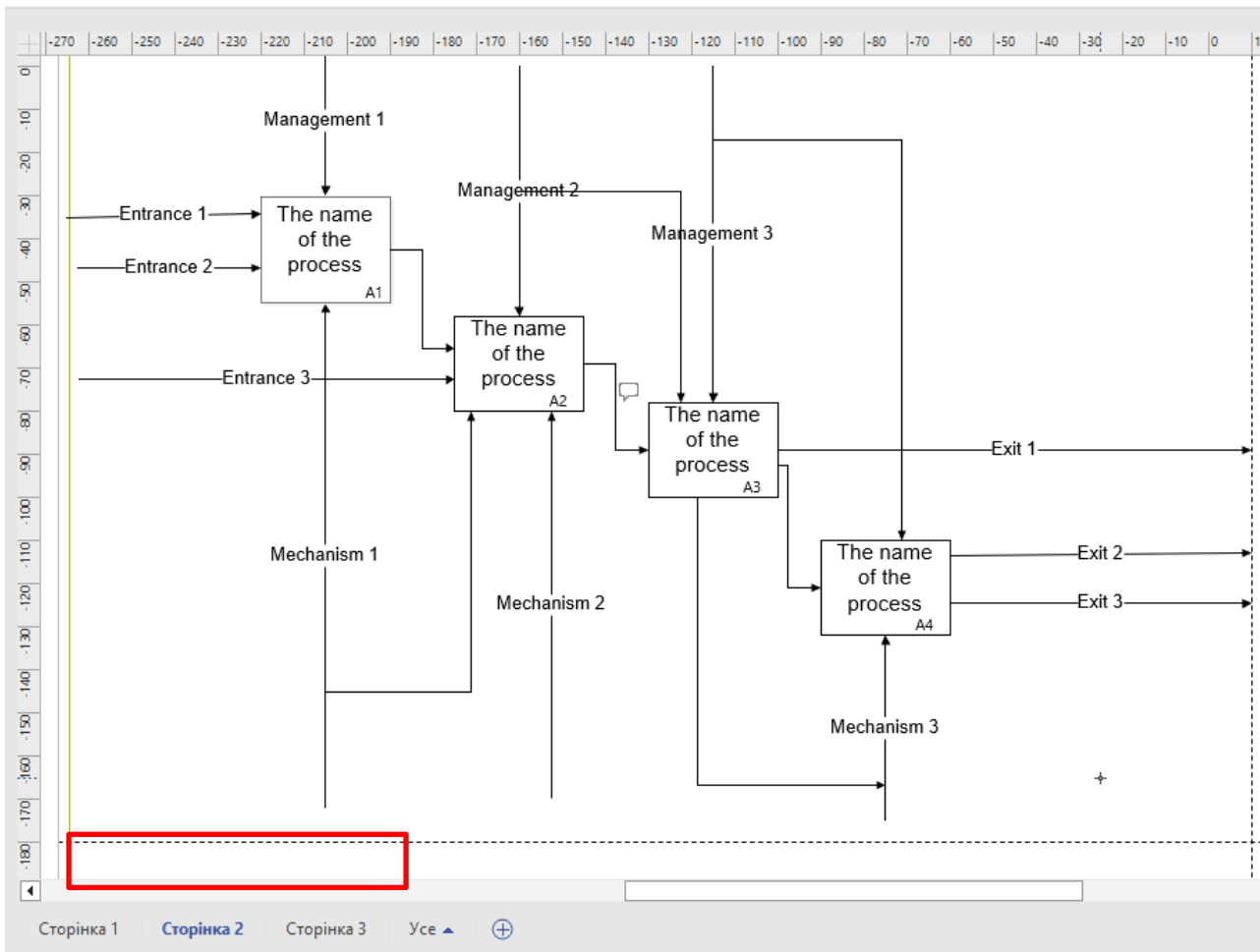


Fig. 19. Switching between project models

Checklist questions

1. What is a procedure and a business process?
2. Name the main elements of the IDEF0 diagram.
3. What types of interface arcs are used in the IDEF0 standard? Give their characteristics.
4. What is the expansion and generalisation relation? Give an example.
5. What is the inclusion relation? Give an example.
6. Who can be an actor in a Use Case diagram?
7. What are the standard types of relationships between actors and use cases in a Use Case diagram?

References: [5; 10; 12; 17; 19 – 21; 24].

Case study on theme 5. Forecasting industry trends by anti-crisis financial decision support systems

Topic. Grouping of business entities by the cluster analysis method.

The objective of the case is to identify trends in the development of business entities in the industry under study by comparing the level of their financial condition in different periods of time.

Guidelines

The natural evolution of anti-crisis decision support systems resulted in the emergence of data mining technology. Data mining is the process of identifying new knowledge based on the processing of large data sets. One of the main tasks of data mining is to effectively identify meaningful knowledge from the existing large data set.

The process of data mining includes the following stages: 1) study of the subject area – formulation of the main objectives of the analysis; 2) data collection; 3) data pre-processing (elimination of contradictions, integration of data from several sources, transformation into a form suitable for analysis); 4) data analysis – application of intellectual analysis algorithms to identify new knowledge; 5) interpretation of the identified knowledge and its visualisation; 6) use of new knowledge.

Cluster analysis can be used for the intellectual analysis of a large data set, which allows analysing a set of objects without specific class features. Clustering is aimed at identifying labels by which research objects can be grouped. Objects are clustered on the basis of the principle of maximising intra-class and minimising inter-class proximity.

Cluster analysis (clustering) is one of the tasks of data mining, which is the process of grouping data into classes (clusters). The clusters identified as a result of data mining should be formed in such a way that objects in one cluster are similar to each other, and objects in different clusters are dissimilar.

A cluster is a group of objects that have similar properties. Each defined cluster is considered as a class of objects that can be further investigated in other types of intellectual analysis to obtain various rules and patterns. Thus, clustering of financial data is a descriptive procedure that allows for preliminary analysis and investigation of the data structure of business entities.

Procedure

1. Create a data set for analysing financial data in the crisis management system. Using the information published on the smida.gov.ua portal, select at least five indicators that characterise the financial condition of the industry's enterprises for 2 periods of time (Table 12).

Table 12

An array of input data for solving the problem of clustering in the framework of making anti-crisis financial decisions

No.	Subject of entrepreneurship	Period/indicators									
		20XX					20YY				
		X1	X2	X3	X4	X5	X1	X2	X3	X4	X5
1	2	3	4	5	6	7	8	9	10	11	12
1	Kharkiv bicycle plant named after Petrovskiyi, PJSC	0.59	0.00	1.20	0.33	0.67	0.17	0.00	0.13	0.00	1.25
2	HELZ PJSC	1.83	0.00	6.98	0.61	0.39	0.42	0.43	0.81	0.00	1.20
3	JSC "Ukrainian Energy Machines"	4.22	0.03	2.13	0.85	0.15	2.00	0.31	1.11	0.58	0.42
4	PJSC "Yuzhcable works"	2.92	0.17	0.00	0.85	0.15	3.98	0.01	10.5	0.73	0.27
5	PJSC "Kharkiv the Order "Badge of Honor" machine-building plant"	2.39	0.20	9.57	0.80	0.20	5.70	0.07	5.46	0.85	0.15
6	PJSC "Frunze plant"	3.23	0.23	10.9	0.75	0.25	2.86	0.05	23.7	0.80	0.20
7	JSC "Electromashina"	2.48	0.00	8.07	0.66	0.34	1.85	0.26	8.15	0.39	0.61
8	AVTRAMAT LLC	2.97	0.00	12.8	0.77	0.23	0.95	0.00	1.52	0.47	0.53
9	PJSC "Harverst"	1.93	0.00	1.04	0.57	0.43	1.16	0.14	0.39	0.15	0.85
10	PJSC "Kharkiv bearing plant"	2.13	0.01	4.16	0.41	0.59	0.10	0.00	2.08	0.22	0.78
11	PJSC "Kharkiv transport plant equipment"	0.54	0.50	0.73	0.04	0.96	0.72	0.05	1.19	0.10	0.90

Table 12 (the end)

1	2	3	4	5	6	7	8	9	10	11	12
12	PJSC "Vazhprom-avtomatyka"	0.97	0.26	6.11	0.20	0.80	2.07	0.01	5.23	0.56	0.44
13	PRJSC LZTD	34.9	0.08	21.5	0.98	0.02	5.65	0.00	8.63	0.88	0.12
14	PJSC "Forez"	0.84	0.10	1.48	0.39	0.61	1.19	0.00	0.73	0.43	0.57
15	PJSC "Tochprylad"	4.78	0.00	15.8	0.81	0.19	0.26	0.00	0.21	0.10	0.90

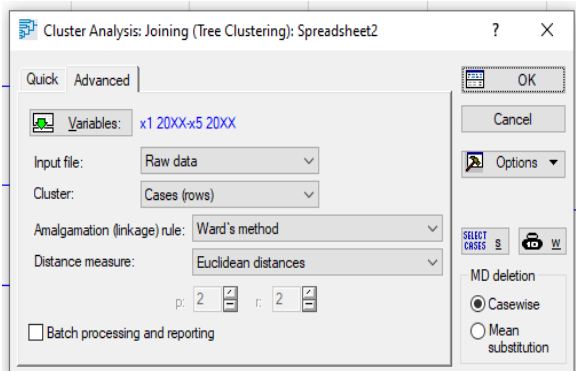
2. Standardise the input data set by using the menu bar commands in Statistica: DATA → STADARTIZE. The result of standardisation is shown in Fig. 20.

The screenshot shows the Statistica software interface with the 'Standardize' menu option highlighted. Below the menu bar, a data table is displayed with standardized values for various enterprises. The table has 11 columns (1-10) and 20 rows of data.

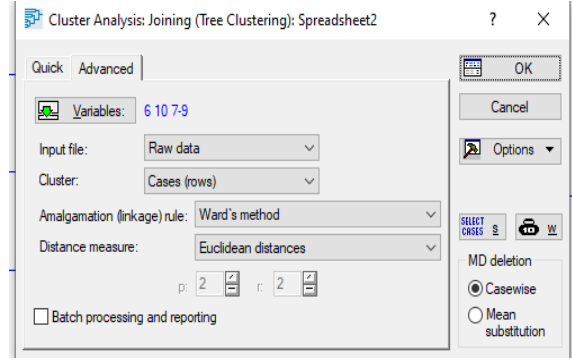
	1	2	3	4	5	6	7	8	9	10
	x1 20XX	x2 20XX	x3 20XX	x4 20XX	x5 20XX	x1 20YY	x2 20YY	x3 20YY	x4 20YY	x5 20YY
KhBPNP	-0.453002	-0.731394	-0.886928	-0.997358	0.9973577	-0.952919	-0.650169	-0.718506	-1.340918	1.767308
HELZ PJSC	-0.307403	-0.731394	0.0234148	0.0318566	-0.031857	-0.818224	2.5029056	-0.610555	-1.340918	1.6286594
JSC "Ukrainian Energy Machines"	-0.026771	-0.523086	-0.740454	0.9140404	-0.91404	0.0330451	1.6229778	-0.56293	0.5226582	-0.534259
PJSC "Yuzhcable works"	-0.179416	0.4490205	-1.075926	0.9140404	-0.91404	1.0998259	-0.576842	0.9277393	1.0046177	-0.950205
PJSC "Kharkiv Order" Badge of Honor "MBP"	-0.241648	0.6573289	0.4313365	0.7302521	-0.730252	2.0265244	-0.136878	0.1276356	1.3901852	-1.282962
PJSC "Frunze plant"	-0.143016	0.8656374	0.6408098	0.5464638	-0.546464	0.4963943	-0.283532	3.023249	1.2295321	-1.144313
JSC "Electromashina"	-0.23108	-0.731394	0.1950884	0.2156449	-0.215645	-0.047772	1.2563413	0.5546751	-0.087824	-0.007
AVTRAMAT LLC	-0.173545	-0.731394	0.9400574	0.6199791	-0.619979	-0.532672	-0.650169	-0.497842	0.1692213	-0.229232
PJSC "Harverst"	-0.295661	-0.731394	-0.912128	-0.115174	0.115174	-0.419529	0.3764135	-0.677231	-0.858959	0.6581189
PJSC "Kharkiv bearing plant"	-0.272177	-0.661958	-0.420732	-0.703296	0.7032965	-0.990634	-0.650169	-0.408942	-0.634044	0.4640108
PJSC "Kharkiv transport plant equipment"	-0.458873	2.7404135	-0.960952	-2.06333	2.0633298	-0.656591	-0.283532	-0.55023	-1.019612	0.7967675
PJSC "Vazhprom-avtomatyka"	-0.408383	1.0739458	-0.113609	-1.475207	1.4752073	0.0707595	-0.576842	0.0911229	0.458397	-0.4788
PRJSC LZTD	3.5756384	-0.175905	2.3102964	1.3918899	-1.39189	1.9995855	-0.650169	0.6308754	1.4865771	-1.366151
PJSC "Forez"	-0.423647	-0.037033	-0.842828	-0.776812	0.7768118	-0.403365	-0.650169	-0.623255	0.0406988	-0.118314
PJSC "Tochprylad"	0.0389831	-0.731394	1.4125536	0.7670098	-0.76701	-0.904429	-0.650169	-0.705806	-1.019612	0.7967675

Fig. 20. The result of standardising the input array of financial data

3. Make assumptions about the number of clusters. To make assumptions about the possible number of clusters formed by the enterprises of the industry, you should use the hierarchical clustering method – the Ward method. To do this, select the following sequence of commands in the programme menu bar: SATATISTICA → MULTIVARIATE EXPLORATORY TECHNIQUES → CLUSTER ANALYSIS. In the window that opens, select the Joining (tree clustering) option and click OK. In the next dialogue box, you should set the analysis settings as shown in Fig. 21.




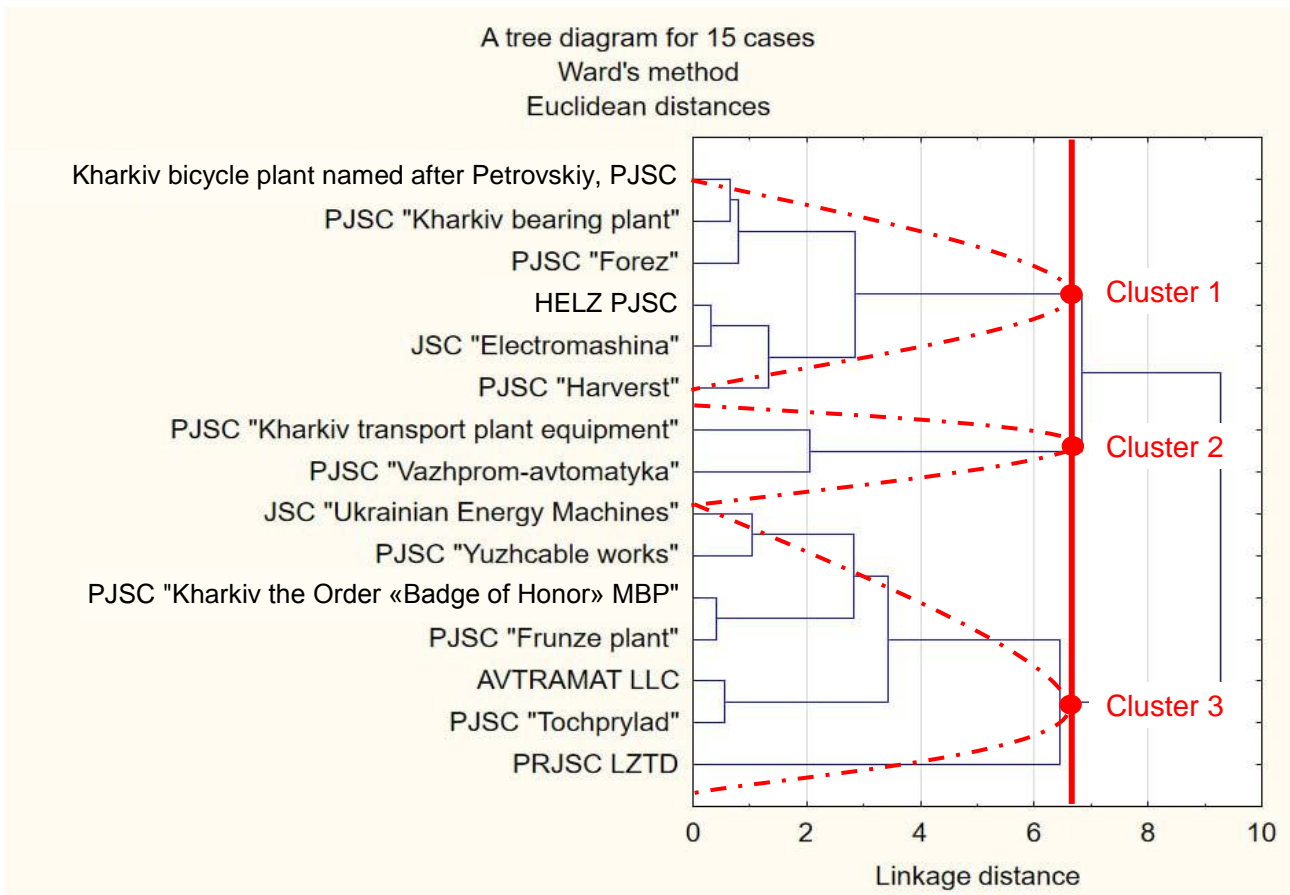
For 20XX year data



For 20YY year data

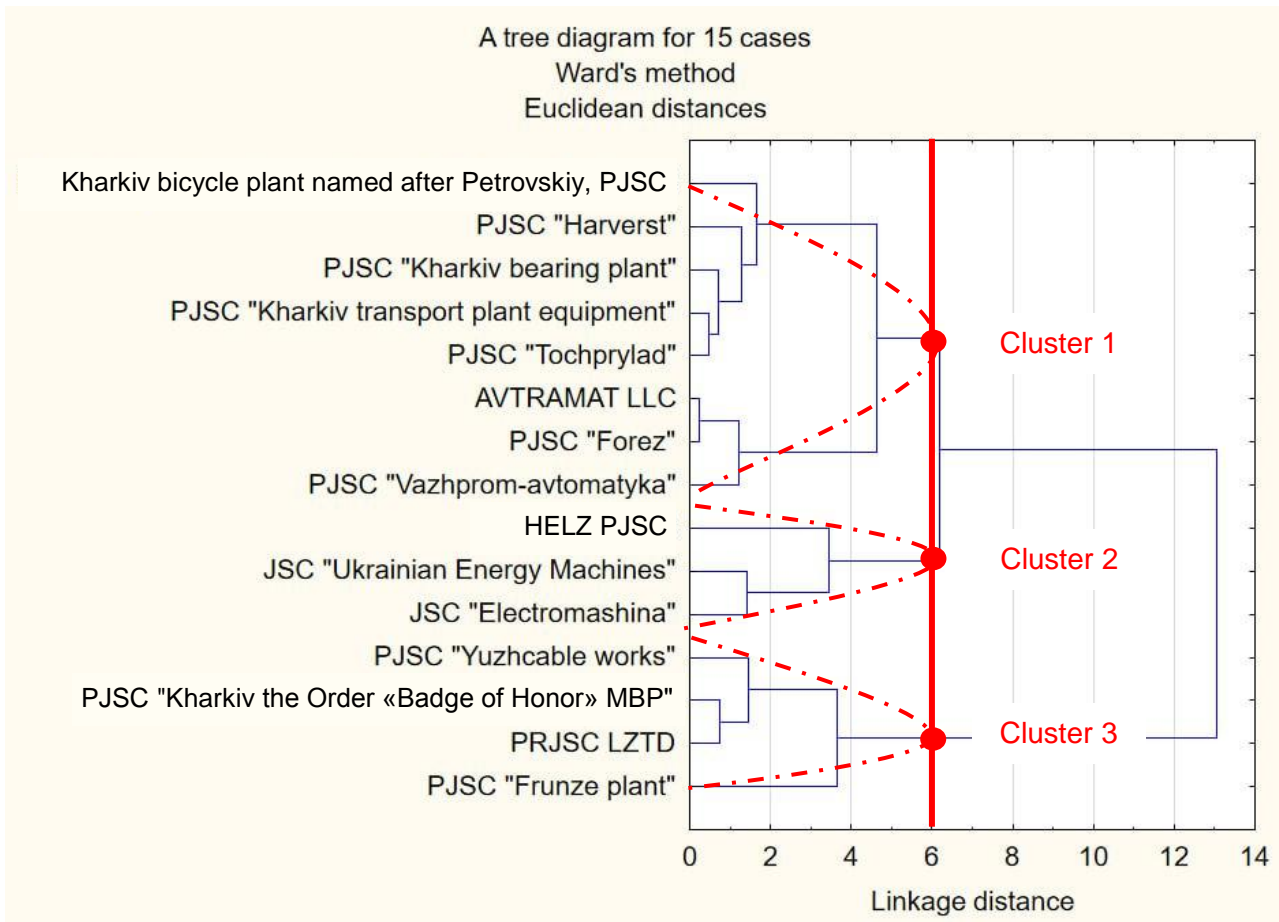
Fig. 21. Setting up analysis parameters

In the next window "Joining Results:" click the button  Horizontal hierarchical tree plot. The dendrogram of clustering of business entities (Fig. 22) allows us to determine that in 20XX at a distance of 6.75, and in 20YY – 5.5, enterprises of the machine-building industry can be formed in three clusters, according to the values of indicators of their financial condition.



a) For 20XX year data

Fig. 22. A dendrogram of machine-building enterprises clustering



b) For 20YY year data

Fig. 22. (the end)

4. The assumption of the identified number of clusters is tested using the k-means method. To do this, double-click on the "Scan" button: in the "Joining Results:" window and the next one that appears after it.

In the "Clustering Method:" window, select K-means clustering and click "OK". In the next dialogue box, you should set the settings as shown in Fig. 23.

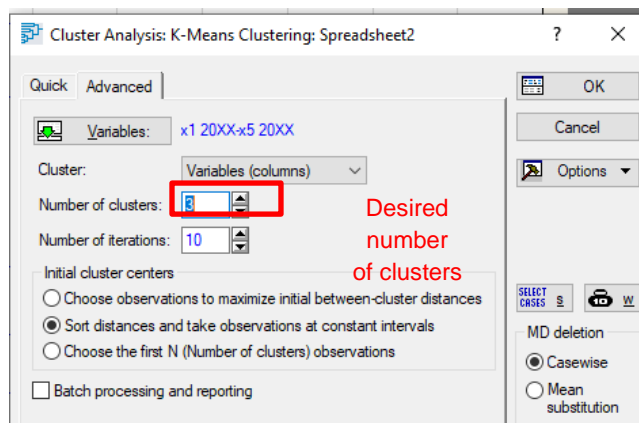
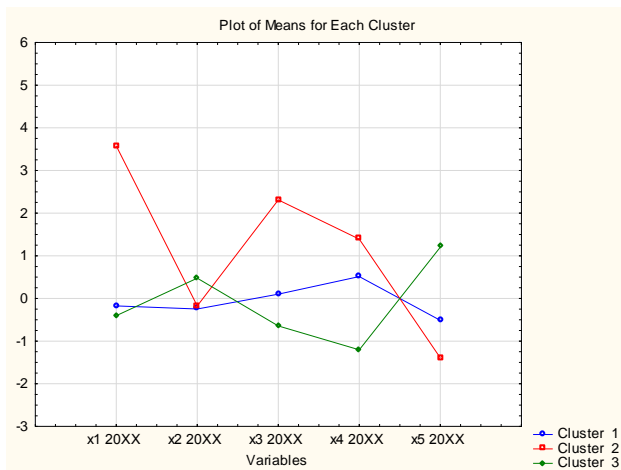
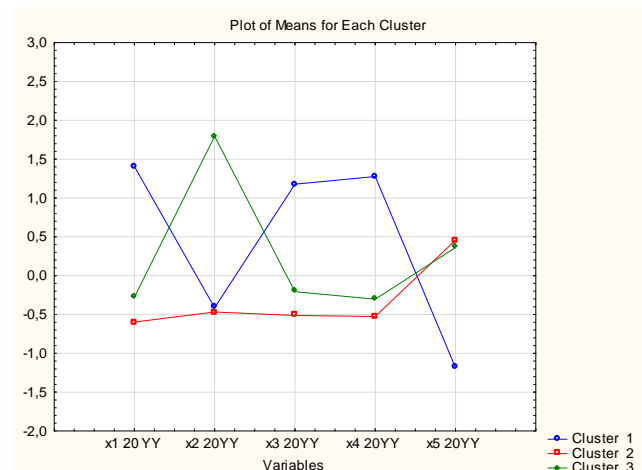


Fig. 23. Setting up analysis parameters using the k-means method

In the "k-Means Clustering Results:" dialogue box, go to the "Advanced" tab and click the "Graph of means" (Fig. 24), "Analysis of variance" (Fig. 25) and "Members of each cluster & distances" (Fig. 26) buttons in turn to analyse the average values of the indicators of the financial condition of business entities, the variance and composition of each identified cluster, respectively. To get extended results of the cluster analysis, click on the "Descriptive statistics for each cluster" buttons.



For 20XX year data



For 20YY year data

Fig. 24. A graph of average values of indicators of the financial state of business entities

Variable	Analysis of Variance (Spreadsheet2)				
	Between SS	df	Within SS	df	F
x1 20XX	13,86835	2	0,13165	12	63,3
x2 20XX	1,70934	2	12,29066	12	
x3 20XX	7,51063	2	6,48937	12	
x4 20XX	11,55164	2	2,44836	12	2
x5 20XX	11,55164	2	2,44836	12	2

For 20XX year data

Variable	Analysis of Variance (Spreadsheet2)				
	Between SS	df	Within SS	df	F
x1 20YY	11,00119	2	2,998814	12	22,0
x2 20YY	12,07821	2	1,921792	12	37,5
x3 20YY	7,76421	2	6,235795	12	7,4
x4 20YY	9,01409	2	4,985909	12	10,8
x5 20YY	7,69074	2	6,309263	12	7,5

For 20YY year data

Fig. 25. The results of the analysis of variance

The analysis of variance (Fig. 26) characterises the quality of the cluster analysis. The value in the **Between SS** column should exceed the value in the **Within SS** field. Indicators of the financial condition of enterprises for which this condition is not met can be excluded from further research, since

they do not have a qualitative impact on the results of clustering enterprises. In 20XX, such indicators include X2 – return on equity. The larger the numerical value of the F field, the more significant is the impact of the financial indicator on the division of enterprises into clusters. For example, in 20XX, the level of their total (current) liquidity influenced the grouping of industry enterprises according to their financial condition.

Members of Cluster Number 1 (Spreadsheet2) and Distances from Respective Cluster Center Cluster contains 9 cases		Members of Cluster Number 1 (Spreadsheet2) and Distances from Respective Cluster Center Cluster contains 4 cases	
	Distance		Distance
HELZ PUBJSC	0.380756	PJSC YUZH CABLE WORKS	0.25026
JSC "Ukrainian Energy Machines"	0.475001	PJSC "Kharkiv Order" Badge of Honor"MBP"	0.56306
PJSC YUZH CABLE WORKS	0.661700	FRUNZE PLANT PJSC	0.92243
PJSC "Kharkiv Order" Badge of Honor"MBP"	0.452084	PRJSC LZTD	0.39608
FRUNZE PLANT PJSC	0.552816		
JSC ELECTROMASHINA	0.291925		
COMPANY AVTRAMAT LLC	0.438576		
PJSC HARVERST	0.643450		
PJSC "Tochprilad"	0.652387		

Members of Cluster Number 2 (Spreadsheet2) and Distances from Respective Cluster Center Cluster contains 1 cases		Members of Cluster Number 2 (Spreadsheet2) and Distances from Respective Cluster Center Cluster contains 8 cases	
	Distance		Distance
PRJSC LZTD	0.00	KhBPNP	0.718812
		COMPANY AVTRAMAT LLC	0.445400
		PJSC HARVERST	0.429471
		PJSC KHARKOV BEARING PLANT	0.204710
		PJSC "Kharkiv transportplantequipment"	0.282101
		PJSC "Vazhprom-avtomatika"	0.730366
		PJSC "Forez"	0.383680
		PJSC "Tochprilad"	0.323833

Members of Cluster Number 3 (Spreadsheet2) and Distances from Respective Cluster Center Cluster contains 5 cases		Members of Cluster Number 3 (Spreadsheet2) and Distances from Respective Cluster Center Cluster contains 3 cases	
	Distance		Distance
KhBPNP	0.566651	HELZ PUBJSC	0.853344
PJSC KHARKOV BEARING PLANT	0.610580	JSC "Ukrainian Energy Machines"	0.589407
PJSC "Kharkiv transportplantequipment"	1.158148	JSC ELECTROMASHINA	0.469813
PJSC "Vazhprom-avtomatika"	0.396731		
PJSC "Forez"	0.365290		

For 20XX year data

For 20YY year data

Fig. 26. Composition of clusters

Determining the trends in the development of business entities in the studied sector of the economy is carried out by solving the problem of generalisation in the framework of supporting anti-crisis financial decision-making (Table 13).

Table 13

Changes in the qualitative composition of clusters formed by enterprises with different levels of financial condition indicators

Entrepreneurial entity	Type of cluster according to level of financial condition		The overall dynamics of changes in financial state	
	20XX year	20YY year	4	5
1	2	3	4	5
Kharkiv bicycle plant named after Petrovskiyi, PUBJSC	Low	Low	No changes	–

Table 13 (the end)

1	2	3	4	5
HELZ PUBJSC	Middle	Middle	No changes	–
JSC "Ukrainian Energy Machines"	Middle	Middle	No changes	–
PJSC "Yuzhcable works"	Middle	High	Growth	↗
PJSC "Kharkiv the Order "Badge of Honor" machine-building plant"	Middle	High	Growth	↗
PJSC "Frunze plant"	Middle	high	Growth	↗
JSC "Electromashina"	Middle	Middle	No changes	–
AVTRAMAT LLC	Middle	Low	Deterioration	↓
PJSC "Harverst"	Middle	Low	Deterioration	↓
PJSC "Kharkiv bearing plant"	Low	Low	No changes	–
PJSC "Kharkiv transport plant equipment"	Low	Low	No changes	–
PJSC "Vazhprom-avtomatyka"	Low	Low	No changes	–
PRJSC LZTD	High	High	No changes	–
PJSC "Forez"	Low	Low	No changes	–
PJSC "Tochprylad"	Middle	Low	Deterioration	↓

Checklist questions

1. How is the quality of the cluster analysis determined?
2. How to determine the elementary set of the obtained clusters?
3. What does the classification dendrogram show?
4. What does the graph of average values for clusters show?
5. How is the number of clusters determined for the k-means method?
6. What procedure (operation) is a mandatory step before conducting cluster analysis?

References: [5; 10; 12 – 16; 17; 19 – 22; 24].

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НАВЧАЛЬНЕ ВИДАННЯ

СИСТЕМИ ПІДТРИМКИ ПРИЙНЯТТЯ АНТИКРИЗОВИХ ФІНАНСОВИХ РІШЕНЬ

**Методичні рекомендації
до самостійної роботи
для студентів спеціальності
072 "Фінанси, банківська справа та страхування"
другого (магістерського) рівня
(англ. мовою)**

Самостійне електронне текстове мережеве видання

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Редактор *З. В. Зобова*

Коректор *З. В. Зобова*

Подано основні питання тем, що вивчають за планом лекцій із навчальної дисципліни, завдання до самостійної роботи та методичні рекомендації до них. Запропоновано кейсові завдання для індивідуальної роботи, тестові завдання, запитання для самооцінювання та теми для написання есе.

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