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Relations
Iryna IVASHCHUK

« _31_ » _____ 2023

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Interim Vice-Rector
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Viktor OSTROVERKHOV

« _31_ » _____ 2023

COURSE OUTLINE

"INFORMATION TECHNOLOGIES FOR MODELING AND FORECASTING IN INTERNATIONAL MANAGEMENT"

Degree of higher education –   master

Field of knowledge: 07 Management and administration

Specialty: 073 Management

Educational and scientific program: "International management"

Department of theory and history of the state and law

Form of study	Study year	Semester	Lectures	Practical classes	Training, CPIT	Individ Work	Stud.-self study	Total	Exam/ Credit
Full-time	I	2	30	15	6	5	64	120	Exam

Ternopil – 2023

The course outline was developed based on the educational and Scientific Master's Degree Program in the Field of Knowledge 07 Management and Administration, specialty 073 Management, approved by the Academic Council of WUNU, Minutes No. 10 from June 23, 2023.

The course outline was prepared by the Associate Professor of the Theory and History of the State and Law Department, Ph.D. Olha KOVALCHUK.

The course outline was considered at the meeting of the Theory and History of the State and Law Department, Minutes No. 1 from August 30, 2023.

Acting Head of Department
JSD, Associate Professor   Natalia CHUDYK

Considered and approved by Support group of specialty 073 «Management», Minutes No. 1 from August 31, 2023.

Head of Support group of specialty,
Doctor of Economic Sciences, Prof.   Mykhailo SHKILNYAK

Guarantor of the ESP   Tatiana DLUHOPOLSKA

STRUCTURE OF THE COURSE
"Information technology for modeling and forecasting in international management"

1. Description of the discipline "Information Technology for Modeling and Forecasting in International Management"

Discipline – Information technology for modeling and forecasting in international management	Field of knowledge, specialty, educational and professional program, higher education degree	Characteristics of the educational discipline дисципліни
Number of ECTS credits – 4	**Field of knowledge** – 07 Management and Administration	**Discipline Status:** normative **Language of study:** English
Number of credit modules – 4	**Specialty** – 073 Management	**Year of study** – 1 **Semester** – 2
Number of content modules – 3	**Educational and scientific program** "International Management"	**Lectures -** 30 hours. **Practical lessons –** 15 hours
Total number of hours –120	**Higher education degree** – master	**Student-self study –** 64 hours **Training, CPIT –** 6 hours. **Individual work -** 5 hours
Weekly hours – 8 hours, **of which classroom hours -** 3 hours		**Type of final control –** exam

2. The purpose and tasks of the discipline "Information Technology for Modeling and Forecasting in International Management"

2.1. The purpose and tasks of the discipline. The purpose of the discipline "Information Technology for Modeling and Forecasting in International Management" is the formation of students' general ideas and skills of formalization of tasks of managing international business processes, construction of conceptual and computer models, use of them to forecast trends of international business processes and support optimal decision-making in international management.

2.2. The task of study of the discipline "Information Technology for Modeling and Forecasting in International Management" is the formation of skills in the correct choice of methods and information technologies for researching the international business environment, building mathematical and computer models; the ability to apply mathematical models and tools of innovative information technologies for modeling and forecasting the effects of international business; the ability to use personal computers to model and forecast trends in the international business environment and make effective business decisions based on the obtained estimated forecasts.

The subject of the discipline – mathematical and computer tools for forecasting and modeling scenarios of the development of international business processes.

2.3. Name and description of competencies, the formation of which ensures the study of the discipline:

GC1. Ability to conduct research at the appropriate level;

GC3. Skills in the use of information and communication technologies;

GC7. Ability to think abstractly, analyse and synthesise;

SC5. Ability to create and organise effective communications in the management process;

SC11. Ability to independently master new knowledge, use modern educational and research technologies in the field of management;

SC12. Ability to formulate modelling problems, create and study mathematical and computer models, and apply statistical methods and models to analyse objects and processes in the field of management.

2.4. Prerequisites for studying the discipline:

- project management

2.5. Learning outcomes.

PLO1. To critically comprehend, select and use the necessary scientific, methodological and analytical tools for management in unpredictable conditions;

PLO2. To identify problems in the organisation and justify methods of their solution

PLO3. To design effective management systems for organisations;

PLO8. To apply specialised software and information systems to solve organisational management problems;

PLO14. To create and study conceptual, mathematical and computer models of objects and processes in the field of management;

PLO15. To identify and classify new tasks in the field of management; to describe, analyse and evaluate relevant objects, phenomena and processes; to choose the best methods of their research.

3. Program of the study discipline "Information Technology for Modeling and Forecasting in International Management"

Content Module 1. Modeling processes in the environment of international business

Topic 1. General principles of modeling trends in international markets and resources

Factors and indicators determining the state of the international business environment. Basic concepts of modeling: original, model, mathematical model, modeling, modeling object. Principles of selectivity and causality. Ways of forming models. The main stages of forming mathematical models. Classification of models: material and ideal models, types of ideal models. Structural, functional, analytical, numerical, simulation models.

Classification of mathematical models according to criteria: behavior in time, types of parameters, structure, type of mathematical apparatus. Basic principles of system analysis. Basic concepts: system, element, structure. Stages of system analysis. Computer experiment: identifying statistically significant interactions between factors of the international business environment. Measures of tendency and variability. Empirical and theoretical distributions. Analysis of variance.

Topic 2. Analysis of international business factors

Factor relationships as a result of causal dependencies. Functional and correlation connections. Concept of correlation and regression analysis. Statistical estimates of indicators: mean, variance. Statistical relationship between features and factors or principal components. Concept of factor model. Methodology for building a factor model for analyzing the international business environment using modern IT tools.

Topic 3. Basic models of international management

Management of international corporations in modern conditions. Models of international management: international model; multinational model; global model; transnational model. Experience curve. Goals of *business* process management models: economic, technological, production, scientific and technical, production, social, and administrative.

Topic 4. Models of conflict situations in the international business environment

Game theory. The concept of rational choice for modeling the rational behavior of players in the international arena. Optimal strategies. Zero-sum games (antagonistic) and cooperative games

(coalition formation). Cooperative games (distribution of profits), coalition games (negotiation strategies and development of political processes in coalitions). Non-cooperative games (resolution of disputes when it is impossible to reach a common agreement). "Prisoner's Dilemma" (mixed motives for behavior). Trial and error method (deciding in the shortest possible time). Decomposition method (breaking a voluminous task into smaller subtasks, taking into account priorities).

Content Module 2. Predictive methods of researching the external environment of international business

Topic 5. Main aspects of forecasting the state of the international business environment

Forecasting, forecasting, and planning. Forecasting alternatives. Forecast scenario. Forecasting conditions. Signs of prediction. Reliability and usefulness of the forecast. Classification of forecasts. The principles of purpose, systematicity, scientific validity, informational unity, alternativeness, and consistent resolution of uncertainty.

The main functions of forecasting trends in international business processes. Stages of scientific analysis: retrospection, diagnosis, projection.

Topic 6. Regression analysis of factors of international business processes

Linear regression model. Strategy, methods, and problems of regression analysis. Simple linear regression. Coefficient of determination. The significance of the regression equation. χ^2 and Fisher's criteria of agreement. Multivariate linear regression. Non-linear regression. Logistic regression. Binary choice models and multiple choice models

Topic 7. Time series for analyzing trends in the international business environment

Time series analysis. Deterministic and random components of the time series. Trend. Seasonal and cyclical components. Trend models. Random component models. Numerical characteristics of time series. Estimates of numerical characteristics of time series. Graphic method of analysis. Methods of reduction to stationarity: selection of a trend; selection of seasonal effects; method of moving averages; seasonal difference operators; scale transformation. Time series analysis using application packages.

Topic 8. Data Mining technologies for managing relationships with international clients

Technologies of data storage and intelligent data analysis for the development of competitive advantage in the international market. Data mining tools to identify valuable customer insights, predict future customer behavior, and help make data-driven decisions. Techniques and approaches to data analysis. for customer relationship management. Extraction. Predictive modeling. Application of templates. Analysis of the consumer basket. Sales forecasting. Database marketing. Data classification and clustering. Clustering methods.

Content Module 3. Innovative information technologies in international business management

Topic 9. Big data in innovative management

Big data technologies for predictive analytics and customer relationship management. Portrait of the client. Determination of the potential audience using the look-alike model. Targeted mailings. Individual request by criteria. Analysis of consumer interests on the Internet. Individual setting of events. Target audience on Facebook. Geoanalytics and heat maps to analyze the attractiveness of the location for the target audience of customers. Big data tools to combat fraud. Financial scoring.

Big data technologies for analyzing internal communications (email, online chats, video conferences, etc.). Big data for personalizing communications. Big data for analyzing external communications (using social media, chatbots, etc.). Big data for evaluating the effectiveness of communication channels and content. Automating routine communications: chatbots, mailings based on rules and preferences.

Topic 10. Text Mining in business risk management

Concepts of Text Analytics. The main tasks of Text Mining. Text Mining techniques for managing business risks: extracting information about customers, tracking topics (customer preferences), summarizing (advertising campaign analysis), categorization (segmentation of groups of goods or consumers by preferences), clustering (identification of groups of counterparties with similar characteristics or consumers with similar preferences), visualization (heat maps of business locations, diagrams of networks of social relationships of consumers or competitors), identification of patterns and relationships (formation of knowledge about the peculiarities of the business environment), answers to questions, identification of associative rules (interrelationships between elements of the business environment). Classification of texts to obtain information about industry trends or international financial markets.

Topic 11. Information technologies to support decision-making in international management

Brainstorming method. Finding a solution by stimulating creative activity. Search for non-standard approaches. Methods of commissions. Formation of ideas by experts through discussions. The Delphi method. Conducting research using the Delphi method. Assessment accuracy and reliability. Selection of groups of experts. Basic principles of Delphi survey. Forecasting by analogy. Problems related to the use of analogies. Conditions necessary for carrying out a formal analogy. Deviation from formal analogy. Method of scenarios. Expert method. Group activity of experts: presentation of opinions and scenarios of situation development.

4. The structure of credits from the academic discipline "Information Technology for Modeling and Forecasting in International Management"

	Number of hours					
	Lectures	Practical classes	Student-self study	Training, CPIT	Individ. work	Control events
1	2	3	4	5	6	7
Content module 1. Modeling processes in the environment of international business						
Topic 1. General principles of modeling trends in international markets and resources	4	2	5	2	2	questions, assessment of the performance of practical tasks
Topic 2. Analysis of international business factors	2	2	3			
Topic 3. Basic models of international management	2	–	10			
Topic 4. Models of conflict situations in the international business environment	2	–	10			
Total:	10	4	28	2	2	
Content module 2. Predictive methods of researching the external environment of international business						
Topic 5. Main aspects of forecasting the state of the international business environment	2	–	10	2	1	questions, assessment of the performance of practical tasks
Topic 6. Regression analysis of factors of international business processes	4	2	5			
Topic 7. Time series for analyzing trends in the international business environment	2	2	3			
Topic 8. Data Mining technologies for managing relationships with international clients	2	2	3			
Total:	10	6	21	1	2	

Content module 3. Innovative information technologies in international business management						
Topic 9. Big data in innovative management	4	2	10			questions, assessment of the performance of practical tasks
Topic 10. Text Mining in business risk management	2	3	2	2	2	
Topic 11. Information technologies to support decision-making in international management	4	–	3			
Total:	10	5	15	2	2	
Разом:	**30**	**15**	**64**	**6**	**5**	

5. Topics of Practical Classes

Practical class 1

Topic: *General principles of modeling trends in international markets and resources*

Purpose: formation of students' abilities and skills to use statistical research methods in practice to identify statistically significant relationships between factors that determine the state of the international business environment through the software Statistica.

Questions for discussion:

1. Measures of central tendency.
2. Measures of variability.
3. Empirical and theoretical distribution functions.
4. Univariate variance analysis.
5. Multivariate variance analysis.
6. Interpretation of the results of dispersion analysis.

Sources: 1, 2, 4, 13.

Practical class 2

Topic: *Analysis of international business factors*

Purpose: formation of students' abilities and skills in the practical application of factor analysis methods to search for predictable implicit patterns caused by the influence of external or internal factors on the state and trends of the business environment.

Questions for discussion:

1. Formal description of the problem of factor analysis.
2. Identification and study of the statistical relationship of signs with factors or main components.
3. Building a factor model based on selected characteristics of the international business environment.
4. Interpretation of the results of factor analysis.

Sources: 2, 3, 4, 10.

Practical class 3

Topic: *Regression analysis of factors of international business processes*

Purpose: formation of students' abilities and skills to use statistical software packages to solve classification problems based on logistic regression and the application of ROC analysis in the SPS Statistica.

Questions for discussion:

1. Binary choice models and multiple choice models.
2. Logit and probit models.
3. Multinomial logistic regression.
4. Construction of logistic models in SPSS.
5. Interpretation of computer simulation results.

Sources: 5, 9, 12, 13.

Practical class 4

Topic: *Time series for analyzing trends in the international business environment*

Purpose: to form students' skills in constructing simple models describing time series, and forecasting future values of a time series using the Statistica statistical data analysis environment.

Questions for discussion:

1. The concept of a time series.
2. Stationarity, seasonality, and trend.
3. Autocorrelations and partial autocorrelations.
4. Autoregressive integrated moving average (ARIMA) method.
5. Smoothing by moving averages.
6. Testing the series for seasonality.
7. Interpreting time series forecasting results.

Sources: 1, 3, 8, 12.

Practical class 5

Topic: *Data Mining technologies for managing relationships with international clients*

Purpose: to form students' skills in applying Data Mining methods for classifying elements of the international business environment using Statistica.

Questions for discussion:

1. The concept of data classification.
2. Clustering methods.
3. Classification trees (dendogram).
4. K-means method.
5. Interpreting cluster analysis results.

Sources: 1, 4, 6, 14.

Practical class 6

Topic: *Big Data in innovative management*

Purpose: to form students' skills in using Big Data and Data Mining tools to assess the reliability ("attractiveness") of international business partners using Statistica.

Questions for discussion:

1. Peculiarities of forming an information base on big data – "credit histories" (business histories) of international business participants.
2. Scoring model for assessing the "reliability" of business partners.
3. Analytical model description.
4. Estimating forecast accuracy.
5. Choosing the optimal predictive model.
6. Analyzing the results of the computer model application.

Sources: 2, 9, 10, 14.

Practical class 7

Topic: *Text Mining in Business Risk Management*

Purpose: to form students' skills in applying Text Mining methods for textual information analysis using Statistica.

Questions for discussion:

1. Basic concepts and methods of Text Analytics.
2. Text Mining objectives.
3. Automatic classification of texts.
4. Stages of analysis of text documents.
5. Techniques for removing uninformative words in Text Mining.

6. Main results of intellectual analysis of texts.
Sources: 2, 7, 11.

6. Complex practical individual task

Students perform a complex practical individual task from the discipline "Information Technologies of Modeling and Forecasting in International Management" based on a randomly generated sample array of initial (primary) data, designed in the form of an end-to-end practical task. The goal of the implementation of the CPIT is the successful assimilation of the content of the academic discipline. CPIT is drawn up under established requirements; the student uses computer equipment during its execution and design. CPIT is evaluated on a 100-point scale. Completion of CPIT is one of the mandatory components of credit.

7. Student-self study

1. International management models.
2. The essence and objectives of forecasting international business processes.
3. The structure of forecasting the development of international business processes.
4. Methods for forecasting trends in the international business environment.
5. Basic concepts and preliminary analysis of time series.
6. Forecasting time series using ARIMA models.
7. Forecasting trends based on smoothing time series.
8. Basic concepts of parametric time series models.
9. General principles of mathematical modeling and forecasting of international business processes.
10. Statistical methods for studying relationships between factors that determine the state of the modern international business environment.
11. Using nonparametric criteria in forecasting trends in international business.
12. Extrapolation of trends in the international business environment.
13. Mathematical models of conflict situations.
14. Complex systems for modeling the political development of international business processes.
15. Methods for studying relationships between factors in the analysis of international business processes.
16. Forecasting tools for modeling in international marketing.
17. Forecasting using modern application packages.
18. Analysis of intensity and development trends.
19. Time series research and forecasting using the ARIMA model.
20. Methods of multivariate modeling of international relations.
21. Factor analysis in IB.
22. International model of international management.
23. Multinational model of international management.
24. Global model of international management.
25. Transnational model of international management.
26. Cluster analysis.
27. Management of international corporations in modern conditions.
28. Objectives of business process management models.
29. The concept of rational choice as a tool for researching the international business environment.
30. Application of game theory to the study of international business processes.
31. Big Data tools for analyzing the international business environment.
32. Application of Data Mining to support business decision-making.

8. Organization and training

Topic: The use of analytical and computer modeling methods to analyze international business processes and support the adoption of effective business decisions

Training procedure: The application of mathematical modeling methods and the latest information technology tools for the analysis of the international business environment.

1. To analyze the state and trends of the elements of the business environment selected for applied research.
2. Identify the main factors of the problem for the development of an analytical model.
3. Using the tools of modern information technologies, build a computer model to identify the features (trends) of the investigated problem of the international business environment.
4. To interpret the obtained results of computer simulation

9. Evaluation tools and methods of demonstrating learning outcome

The following assessment tools and methods of demonstrating learning outcomes are used in the process of studying the discipline "Information Technologies of Modeling and Forecasting in International Management":

- current survey;
- credit module testing and survey;
- cross-cutting projects;
- presentations of the results of completed tasks and research;
- evaluation of the results of CPIT;
- calculation works;
- tasks to be performed using computing equipment and application programs;
- modular works;
- exam.

10. Criteria, forms of current and final control

The final score (on a 100-point scale) from the discipline "Information technologies of modeling and forecasting in international management" is determined as a weighted average value, depending on the specific weight of each credit component:

Content Module 1	Content Module 2	Content Module 3	Content Module 4 (Exam)
1. Current evaluation (5 topics for 10 points each) = 50 points 2. Practical task = 50 points	1. Current evaluation (6 topics for 10 points each) = 60 points 2. Written work = 40 points	1. Preparation and protection of CPIT - max. 80 points 2. Performance of tasks during training - max. 20 points	1. Theoretical question 1 (30 points) 2. Theoretical question 2 (30 points) 3. Practical task (40 points)

Rating scale:

University Scale	The National Scale	Scale ECTS
90–100	fine	A (fine)
85-89	well	B (very well)
75–84		C (well)
65–74	satisfactorily	D (satisfactorily)
60-64		E (sufficiently)
35–59	unsatisfactorily	FX (unsatisfactorily with possibility of the repeated drafting)
1–34		F (unsatisfactorily with the mandatory repeated course)

11. **Tools, equipment, and software the use of which provides for the educational discipline**

No	Name	Number of topic
1.	Multimedia complex	1-11
2.	Set of presentation materials	1-11
3.	Computer class with a Windows PC	1-11
4.	Software Statistica	1–5, 7–11
5.	SPS Statistica statistical package	6

RECOMMENDED SOURCES OF INFORMATION

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2. Brooke C. The Importance of Information Technology In Business Today. Business Community, 2023. URL : https://www.business2community.com/tech-gadgets/importance-information-technology-business-today-01393380.

3. LaMarco N. Information Technology & Its Uses in Business Management. CHRON, 2018. URL : https://smallbusiness.chron.com/information-technology-its-uses-business-management-51648.html.

4. Shen C.-C., Yeh C.-C., Lin C.-N. Using the perspective of business information technology technicians to explore how information technology affects business competitive advantage. Technological Forecasting and Social Change. 2022. Vol. 184. 121973. URL : https://www.sciencedirect.com/science/article/abs/pii/S0040162522004942/

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9. Kovalchuk O. et al. Decision-Making Supporting Models Concerning the Internal Security of the State. INTL Journal of Electronics Telecommunications, 2023, Vol. 69, no. 2, pp. 301–307.

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12. Berezka K., Kovalchuk O. et al. Binary Logistic Regression Model for Support Decision Making in Criminal Justice. Folia Oeconomica Stetinensia. 2022. Vol. 22 (1), pp. 1–17.

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14. Berezka K., Kovalchuk O. The Application of Association Rules to Detect the Effects of Vaccinations against Covid-19 in the EU-27. Preliminary Estimates. Econometrics. Ekonometria. Advances in Applied Data Analysis, Vol. 27, no. 1, pp. 1–16. https://doi.org/10.15611/eada.2023.1.01. ISSN 2449-9994

15. Kovalchuk O., Kasianchuk M., Karpinski M., Shevchuk R. Decision-Making Supporting Models Concerning the Internal Security of the State. INTL Journal of Electronics Telecommunications, 2023, Vol. 69, no. 2, pp. 301–307. (Scopus). DOI: 10.24425/ijet.2023.144365

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Russian-Ukrainian War Impact on Global Food Safety. Preliminary Evaluations. Proceedings of the 13th International Conference on Advanced Computer Information Technologies (ACIT-2023).

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18. Stream Processing: Instant Insight Into Data As It Flows. E-book. URL : https://hazelcast.com.

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