

# HIGHER EDUCATION AND RISK MANAGEMENT: ANALYZING UNIVERSITY PROGRAMS IN THE EU

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## Abstract

In 2019 the authors of the paper realized the empiric survey based on the project "KEGA" in Slovakia. The goal of this survey was to assess study programs focused on enterprise risk management in European countries. The main aim of the paper is to present the results of the above-mentioned research and to propose the concept of a new study program at the Faculty of Security Engineering of the University of Žilina in Žilina (FSE UNIZA). The level of diversity and significance (importance) of subjects in risk management study programs at universities in the European countries were analysed and evaluated. Based on the achieved results, the concept of key subjects in the new study program Risk Management (Prevention of enterprise crises) was proposed. The proposed concept of study subjects is completed by an extended application of software support in risk management education and respects world trends. The proposed solutions present a contribution for the FSE UNIZA to belong to the advanced European educational institutions through the quality of its educational process and address more potential students, too. The results of this paper are usable also for other universities with similar study programs in Slovakia and the European countries.

Keywords: risk management, education, study program, university, subject, software support

## 1 INTRODUCTION

The actual trends in enterprise risk management highlight the need to pay more attention to the enterprise risk management application and to be better prepared for the threats in the current business environment [1, 2, 3]. This fact is confirmed also by the results of our own research focused on the issue of enterprise risk management carried out by the authors of the contribution, as well as from other worldwide surveys carried out by various organizations such as e.g. Institute Penomon, Enterprise Risk Management Initiative, AMRAE, AICP, Deloitte Institute, etc.) in 2017 – 2019 [4, 5, 6, 7, 8, 9]. The actual trends point to the need to link theory with practice and the need to use software support in higher education at universities around the world [10]. Universities should also provide better study programs in the field of risk management and prepare graduates more effectively for the needs of practice.

**The main aim of the paper** is to present the results of the above-mentioned research and to propose the concept of a new study program at the Faculty of Security Engineering of the University of Žilina in Žilina (FSE UNIZA). The level of diversity and significance (importance) of subjects in risk management study programs at universities in the European countries were analysed and evaluated. Based on the achieved results, the concept of key subjects in the new study program Risk Management for the bachelor degree at the FSE UNIZA in Slovakia was proposed. The proposed concept of study subjects is completed by an extended application of software support in risk management education and respects world trends.

## 2 METHODOLOGY

In 2019 the authors of the paper realized the empiric survey based on the project: „Research of Risk Management in Enterprises in Slovakia to create a new study program Risk Management for the FSE UNIZA“. The main goal of this survey was to assess study programs focused on enterprise risk management in European countries, i.e. Norway, Finland, Sweden, Denmark, Greece, Italy, Germany, Austria, the United Kingdom, France, Portugal, Ireland, Belgium, Spain, Holland, Slovakia, Poland, the Czech Republic, Hungary, Russia.

The empirical research was carried out using scientific methods: the framework analysis, the content analysis, the method of comparison and the synthesis method. The content analysis and framework analysis were applied to assess the diversity and significance (importance) of subjects in risk management study programs at universities in the European countries. The method of comparison was

applied to the assessment of study programs in Slovakia and the European countries. The synthesis method was used to design the concept of the subjects of the new Risk Management study program.

### 3 RESULTS

The authors summarised the processed results as follows:

- results by the analysis of fields of study focused on the issue of enterprise risk management at universities in European countries,
- the proposed concept of subjects of the new field of study Risk Management (Prevention of enterprise crises),
- software support in education in the fields of study Risk Management (Prevention of enterprise crises).

#### 3.1 Results by the analysis of risk management field of study on issues at universities in European countries

Fields of study at universities focused on the issue of risk management in selected European countries (were selected via website) are listed below [10]:

In **Norway**, for example, Stochastic Modeling, Statistics and Risk Analysis field of study at the University of Oslo focuses on the development of various tools based on mathematics, probability, statistics, and informatics. These tools are used to measure the risk of financial investment or find an optimal strategy. The Risk Management field of study at the University of Stavanger provides students with the knowledge and basic thinking. They need to approach risk and uncertainty to support decision making. The Risk Analysis and Management field of study at the same university provides knowledge of the fundamentals of risk analysis and management, strengthening the scientific basis for risk and science, including relevant safety and security issues.

In **Finland**, for example, Laurea University of Applied sciences has a Security, Protection and Risk Management field of study that includes, in addition to security management and risk management also the basics of business, customer-oriented service development, management, and economic and commercial law. This field of study focuses on a comprehensive understanding of the importance of security, protection and risk management at social, corporate and individual levels.

In **Sweden**, for example, Lund University has a Disaster risk management and climate change adaptation fields of study. This covering topics such as risk assessment and management, social resilience, disaster management, and coordination, preparedness planning and capacity development.

In **Denmark**, for example, Aalborg University has a Risk and Safety Management field of study. It provides insights into the underlying probability theory and data collection in the context of risk analysis and social conditions relevant to risk control. At the University of Copenhagen exist a Security Risk Management field of study that offers competence in new security and risk management practices, identifying new opportunities and developing a risk management strategy.

In **Greece**, for example, the Risk Management study field of study at Alba Graduate Business School is designed to develop professionals. They will be able to identify, measure and manage the risks inherent in investments, business decisions or financial transactions.

In **Italy**, for example, Luiss Business School has a Risk Management and Insurance field of study. It focuses on developing strategic capabilities and managerial competencies to implement risk analysis, evaluation, and management. Institute for Advanced Study of Pavia provides a Risk and Emergency Management field of study. It aims to train students in the assessment, mitigation, and management of extreme events (before and after their occurrence). The field of study focuses primarily on natural disasters and secondly focuses on human, technological and biomedical risks. At Guglielmo Marconi University, the Risk Management field of study provides training in internal control, corporate governance, risk management, and audit. It prepares students to work in public and private organizations and financial companies. The University of Pisa field of study offers theoretical and practical skills to manage the main sources of risk characterizing financial markets, insurance companies, pension funds or business. At the University of Florence, the Finance and Risk Management field of study provides education in finance, quantitative risk and insurance management, banking and financial accounting. The Engineering Program for Natural Risk Management encompasses disciplines closely related to natural hazards and information and communication technologies and prepares

experts capable of working in all areas of civil, public and private security, national and international security. At the University Commerciale Luigi Bocconi, the Cyber Risk Strategy and Management field of study analyzes and implements cyber risk strategies, management tools, and evaluation tools. The Finance, Insurance, and Risk Management field of study leverage their advanced quantitative financial and econometric skills in asset management, banks, insurance companies, consulting firms and large corporations. At the Trieste School of Management, the Insurance and Risk Management field of study provides students with a comprehensive understanding of current management issues, with particular reference to the areas of insurance, risk management, and finance.

In **Germany**, for example, RWTH Aachen University International Academy has a field of study Management and Engineering in Underground Construction. This field is also oriented to qualitative and quantitative risk analysis in industrial processes, development and practical implementation of risk management strategies during emergencies. There is an International Management - Focus on Creative Management field of study at SRH Hochschule Berlin. The field of study aims to appropriately identify and manage environmental risks. At the Hochschule Magdeburg-Stendal, the Entrepreneurial Risk Management field of study focuses on functions such as risk prevention, analysis, and control. Risk management expertise is communicated in an interdisciplinary way. Students will acquire competencies in the respective operational areas of organizations and management. The Master of Finance field of study at the Frankfurt Institute for Risk Management and Regulation provides education in financial, market risk, risk modeling, etc. At Ulm University there is a part-time field of study in Actuarial Science. This field of study is designed to develop professionals who will have a deeper understanding of risk modeling, financial mathematics, statistics, corporate risk management, insurance, and accounting. The International Security Management field of study at the Berlin School of Economics and Law is based on risk and safety management. It provides an interdisciplinary course at the interface of security disciplines in legal sciences, information technology, economics, and social sciences.

In **Austria**, for example, FH Campus Wien has a Risk Management and Corporate Security field of study. The field of study Quantitative Asset and Risk Management is at the University of Applied Sciences BFI in Vienna. These fields are focused on statistical and mathematical analyzes and the quantitative aspects of risk analysis. Fields of study do not only deal with risk management, but also with corporate security. The aim of the field of study is effective risk management and prevention, as well as the application of individual tools to effectively manage business crises at all levels of the enterprises.

In the **United Kingdom**, for example, the fields of study Finance, Investment and Risk and International Banking, Finance and Risk Management are at the Glasgow School for Business and Society and Glasgow Caledonian University. There is a field of study Risk and Security Management at the University of Portsmouth. The fields focus mostly on addressing financial and economic risk management issues at all levels. Fields of study are to a lesser extent aimed at risk management through insurance. They are always oriented according to the need of practice with direct application to individual problems in the form of case studies. The content of risk management studies is focused on the use of quantitative risk analysis in the process of risk assessment. Emphasis is placed on the use of IT technology, with application in software products.

In **France**, for example, EISTI Graduate Engineering School has a Quantitative Finance and Risk Management field of study. This field of study focuses on linking risk management with financial management. The field of study International Risk Management is at ESDS Lyon Business School, subjects are focused on effective risk management, mainly cybersecurity of individual information systems. At the University of Côte d'Azur, the Environmental Hazards and Risks Management field of study focuses on risk management, ecology principles, industrial chemistry, mathematical risk modeling, etc. NEOMA Business School has a Risk and Financial Technologies degree field of study. It focuses on education in qualitative and quantitative analysis in the process of risk analysis, risk management models, or financial management. Field of study Risk Engineering and Management is at INSA Toulouse - Institute of National des Sciences Appliquées. This field of study is focused on addressing risk analysis in occupational health and safety, creating safety, hazardous substances and their impact on the human body. There is a Financial Regulation and Risk Management field of study at the University of Sciences Po. It is the focus on risk management in the areas of macroeconomics, financial analysis, and financial markets.

In **Portugal**, for example, The field of study Statistics and Information Management - Risk Analysis and Management is at NOVA IMS University. This field of study provides education in banking, insurance, investment, market management, risk management. At other universities, risk management is taught

only within individual subjects in the fields of study. It is usually a one-semester course focused on the basics of risk management.

In **Ireland**, for example, Managing Risk and System Change fields of study are at Trinity College Dublin. Risk Management and Insurance is at the University of Limerick. Food Safety & Risk Analysis is at University College Dublin. Financial Risk Management is at Trinity College Dublin. The Institute of Technology Sligo has Environmental, Health, and Safety Management. Economic and Financial Risk Analysis is at Maynooth University. In the mentioned fields of study, the emphasis is placed in the process of teaching risk management, especially on the issue of financial management and the application of individual quantitative methods of risk analysis. To a lesser extent, the study of risk management also deals with the issues of food safety, environmental risks, personnel risks, as well as the issue of health and safety at work itself. General risk management is part of several fields of study in Ireland. It receives very little attention in them.

In **Belgium**, for example, Security and Strategic Studies field of study exist at Vesalius Collage. In this field of study, risk management focuses on security at the national and international level in the field of study of international crisis management. The application of management methods and techniques that are useful in enterprise risk management forms an integral part of the fields of study focused on the risk management of the enterprise. Risk management is also taught in other areas, but only to a very limited extent.

In **Spain**, for example, the Risk Prevention field of study is at the University of Granada focusing on risk prevention, occupation health and security and safety, occupational safety, ergonomics, and social psychology. The aim of this field of study is to enable students to develop coherent, multidisciplinary and innovative approaches to conduct research.

In the **Netherlands**, for example, the field of study Actuarial Science and Mathematical Finance - Quantitative Risk Management is at the University of Amsterdam. The study of risk management is devoted to the combination of mathematical-statistical analyzes and risk management in connection with insurance. Students are able to properly assess the risks arising from individual types of insurance and appropriately set the appropriate form of insurance, both life, and non-life.

In **Poland**, for example, SGH Warsaw School of Economics and University of Economics and Human Sciences in Warsaw have a field of study Risk Management. This field of study focus education on issues of law, ethics, audits, corporate governance, and risk management concepts. Risk management is also part of the fields of study Crisis Management and Security Management. This field of study provides WSB University in Chorzów, the University of Business and Administration Eugeniusz Kwiatkowski in Gdynia, Business College in Dąbrowa Górnicza, Poznań School of Banking, The International University of Logistics and Transport in Wroclaw and Collegium Humanium Warsaw Management University, too.

In **Hungary**, for example, Crisis Management field of study is at the National University of Public Service. The aim of this field of study is to train experts in disaster management of various types. The International Business School has a field of study Financial Management that includes security and risk management in their education. There are few fields of study focused directly on risk management.

In the **Czech Republic**, for example, the field of study Safety Engineering is at the Technical University of Ostrava, Faculty of Safety Engineering. The graduate is able to assess potential threats in order to implement and systematic measures and strategies in the field of prevention of major accidents, analysis, and risk assessment. Field of study Process Engineering is focused also on the issues of accident prevention and liquidation, crisis and security management at the Tomas Bata University in Zlín, Faculty of Logistics and Crisis Management. Field of study Risk Management of Technical and Economic Systems is at the Brno University of Technology, Institute of Forensic Engineering. The field of study focuses on the development of engineering approaches, the creation of draft measures for new technical and economic objects to identify and analyze the risks of negative events in the assessed objects and propose measures to minimize them.

In **Slovakia**, for example, the field of study Management of Technical and Environmental Risks in Engineering exist at the Technical University of Kosice, Faculty of Mechanical Engineering. This addresses the issue of risk management in the work environment. Field of study Security Systems Management is at the University of Security Management in Kosice. It offers students training in security management, crisis management, and risk management. At the University of Žilina in the Faculty of Security Engineering is a field of study Crisis Management. This field of study also addresses the issue of risk management in the conditions of public administration and business entities. Graduates are able



to assess (identify, analyze, evaluate) risks and threats in natural, social, economic and technological processes, as well as to propose ways to reduce them. In Slovakia, several universities deal with the issue of risk management. However, none of them offer a separate risk management field of study.

Fields of study Risk management are diverse and specific in each country. In individual countries, Risk management is most often taught through economic or managerial-economic fields of study at universities. Some universities have developed and separate risk management field of study. Other universities deal with risk management issues in business management, economics, financial management, insurance, law, corporate quality management, etc. Other technical-type universities and colleges have developed fields of study that provide training in occupational health, technological safety, the environment and risk analysis in industrial enterprises. It was confirmed that the issue of risk management is on the one hand earmarked into a separate specialization, but on the other hand, it grows into several disciplines.

It can be concluded that the importance of risk management is growing both locally and globally from the above. This is also evidenced by a number of fields of study, institutions, and associations dealing with this issue in Europe [12].

### 3.2 Proposal of the concept of subjects of the new field of study Risk Management (Prevention of Enterprise Crises)

The analysis was based on the assessment of diversity and importance (importance) of fields of study focused on the issue of risk management at universities and colleges in European countries. In most of them, risk management is embedded in the economic or managerial field of study and oriented to specific environments such as the banking sector, insurance companies, technology process risks, fire risks, risk management relationship and quality management, natural risks in regions and so on [12, 13]. The issue of Risk Management is most sophisticated in financial institutions in Slovakia (banks and insurance companies) [14]. This is also reflected in the staffing of the Risk Management departments.

At the Faculty of Security Engineering, University of Zilina (FSE UNIZA), Slovakia, the problems of risk management are closely studied within the field of study Crisis Management. Especially after the last accreditation at FSE UNIZA, the subjects focusing on theory and practice of risk management have been substantially fostered. The risk management issues are studied within several specific subjects, in the field of study Crisis Management [15, 16, 17].

This created the need to create a new study program Risk Management (Prevention of Enterprise Crises) field of study that respects current global trends in business management and education. Table 1 shows **the concept of the key subjects of the new study program Risk Management (Prevention of enterprise crises)** at the FSE UNIZA in Slovakia for bachelor studies.

Table 1. The concept of the key subjects of the new study program Risk Management (Prevention of Enterprise Crises) at the FSE UNIZA in Slovakia for bachelor studies.

The concept of the new study program Risk Management (Prevention of Enterprise Crises)		
1rd-year student	Winter semester	Summer semester
<b>Compulsory subjects</b>	Economy Mathematics Engineering Geometry Basics of Technical Sciences	Enterprise Economy Management Managerial Statistics Applied Informatics
<b>Compulsory optional subjects</b>	Introduction to the Study Law Health and Safety at Work	Marketing Strategic Management Reputation Management
<b>2rd-year student</b>		
<b>Compulsory subjects</b>	Risk Management Financial Management (financial risks, early warning systems) Economic Analyzes (economic risks)	Methods and Techniques of Risk Management Quality Management (quality risks) Production Management (risks arising from production, OSH, working environment, logistics)

	Software Support in Risk Management 1	Operational safety (accidents, environmental risks, fire risks)
<b>Compulsory optional subjects</b>	Change Management Controlling World Economy Foreign Language 1 (English and German)	Reliability of engineering Reliability of the Human Factor Change Management (Management of Innovations) Foreign Language 2 (English and German)
<b>3rd-year student</b>		
<b>Compulsory subjects</b>	Business Continuity Management Operational Analysis (risks in decision making of managers) Project Management (project risks) Personnel Management (personnel risks)	Crisis Management in the Enterprise Enterprise Crisis Management Strategies Management Information Systems (Information risks) Seminar for Bachelor Thesis Defense of Final Thesis
<b>Compulsory optional subjects</b>	Insurance Personality of Crisis Manager (crisis communication, work organization) Enterprise Culture and Organizational Behavior Foreign Language 3 (English and German)	Geopolitics (political risks) Legal Environment of Risk Management (legal risks) Professional Practice

### 3.3 Software support in education in the field of study Risk Management

Information systems, computing, and complex software products have become an integral part of teaching at all universities nowadays. As part of the proposed new field of study Risk Management (Prevention of enterprise crises) at the Faculty of Security Engineering of the University of Zilina. It is necessary to pay more emphasis on the use of various software products when teaching individual subjects.

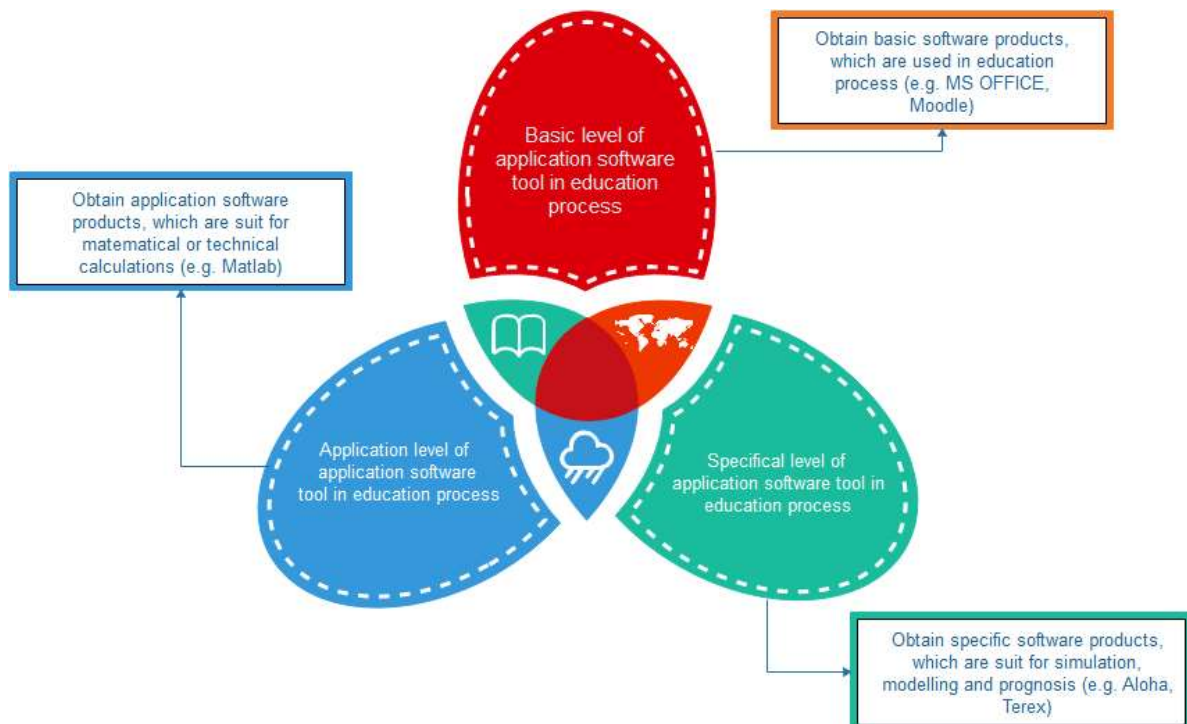


Figure 1. Levels of software products in the teaching process.

The proposed concept of study subjects is complemented by an extended application of software support in the educational process from the perspective of three levels, Figure 1:

1. Basic level - streamlining procedures and processes in student education through standard softwares (for example Moodle software, MS Office)

2. Application level - application of more complicated technical calculations through software for mathematical-technical analyzes.
3. Specific (upgrade) level - acquiring practical skills in using software tools with modeling and simulation.

**1. The first - basic level of application software tool obtain software products, which are used in the education process**, for example, software Moodle, MS Office.

**a) Application of Moodle software in the educational process**

Moodle ("Modular Object-Oriented Dynamic Learning Environment".) is an online platform, which is suit for the education process. It provides custom learning environments not only for the student, but for teachers, too. Teachers may create new modules (courses) and provide virtual itineration with students. Students may submit their assignments, take some quizzes and interact with their classmates via Moodle platform. Course administrators may create virtual teams and classes, which may cooperate, provide access videos, documents, and tests. This environment is secure with high priority. Moodle classroom may be customized by the course administrator. It is necessary to say, that Moodle never fully replace the classical form of teaching. Moodle is only supported tool, which may be integrated into the education process [18].

**b) Microsoft Office software application**, for example, Microsoft Excel and Microsoft Project.

Microsoft Excel can be used in various subjects in the newly proposed concept of a new field of study. Students of the first-year study can improve their skills in Microsoft Excel on subjects such as Computer Science, Applied Informatics and Managerial Statistics. Excel is used to solve basic and descriptive statistics, regression and correlation analysis, including forecasting. In the second year, students can use Microsoft Excel in the course Economic Analysis to solve econometric models (single-equation, multi-equation, and complex). In addition to macroeconomic analysis, students get knowledge of mitigating the financial risks of the enterprise through various methods and techniques designed for this subject in Financial Management. In the third year, students will be used the software product mainly for the creation model. These can be designed to assess the risks of the occurrence of a selected emergency in the subject Information management systems. In the subject, Crisis Management students learned subject in Project Management about methods, techniques, and tools, which are needed in planning processes, with an emphasis on crisis planning [19].

**2. The second - application level of application software tools in education process consists of software products**, for example, Matlab, etc.

Matlab is a unique platform, designed especially for engineers and scientist. The main heart of the Matlab platform is a matrix-based language, which allows the most natural expression of several computational mathematics. The main advantage of Matlab perform is a combination of the desktop environment and programming language. It is possible to analyze data, develop algorithms and create models and applications. Matlab offers a lot of addons, which is possible to use in the new field of study Risk management. Add-ons applications, which is possible to use they are data science, deep learning, enterprise and systems, machine learning, Internet of things, predictive maintenance, wireless communications. Compatibilities, which are possible to use are cloud computing, data analysis, discrete-event simulation, mathematical modeling, projects, real-time simulation and testing, verification, validation, and test [20].

**3. The third - specific software products, which are suit for simulation, modeling, and forecasting consists of software products**, for example, Aloha, Terex, Epsis, @RISK

The third level aims to provide students with practical skills in using specific software tools associated with modeling and simulation. Department of Crisis Management FBI focuses mainly on modeling and simulation of courses and scenarios of various types of crisis phenomena.

- a) **Aloha** (Areal Locations of Hazardous Atmospheres) is a software tool, which is from CAMEO software products family. It can assess the probability of chemical hazard of a given area after some incidents of hazardous substances. Main inputs of this software ( location of the accident, data on the chemical, meteorological situation and data about accident source) it is possible to use in Crisis management and risk management for solving environmental hazards events. It offers over 652 chemical substances and chemicals in its database. Evaluation of solved situation is in graphic form, and it allows draw specific results on the map [21].
- b) **Program TerEx** is possible to characterize as a simulation tool for accessing the impact of accidents, forecasting and detecting the consequences of hazardous substances or explosive systems,

especially in their terrorist abuse. Model is created by computer simulation with a map background link and a direct map view. In the new field of study - Risk management it is possible to use in subjects, which are focused on enterprise safety. TerEx is intended in particular for simulation of specific sources of risks in industrial processes, civilian crisis and risk planning, army modeling, determination of the threat. Display options on the map are a toxic hazard, explosion hazard, fire hazard, and combined threat [22].

- c) The application **software EPSIS** (Unified Economic Mobilization Information system) serves as a tool for civil emergency planning. EPSIS is used by economic mobilization entities to process or evaluate the documents provided and to collect and classify them for the purposes of decision-making by ministries and other central authorities, district offices, municipalities, and higher territorial units and other economic mobilization entities in a state of security or crisis. The system is divided into individual application parts whose directories are hierarchically arranged and logically interconnected [22].
- d) **@Risk** is suited for risk assessment of technological processes in the industrial environment. It could be applied to the risks social with the implementation of some projects in the area of risk assessment. @Risk is designed as a superstructure of the MS Excel program package. It is possible to use in the new field of study Risk management in the subject - financial management (compare analysis and create various scenario), risk management (scenario), managerial statistics (standard deviation, expected value, Monte Carlo simulation, etc.). It is possible to solve some problems, which are in the area of decision-making processes, too [23].

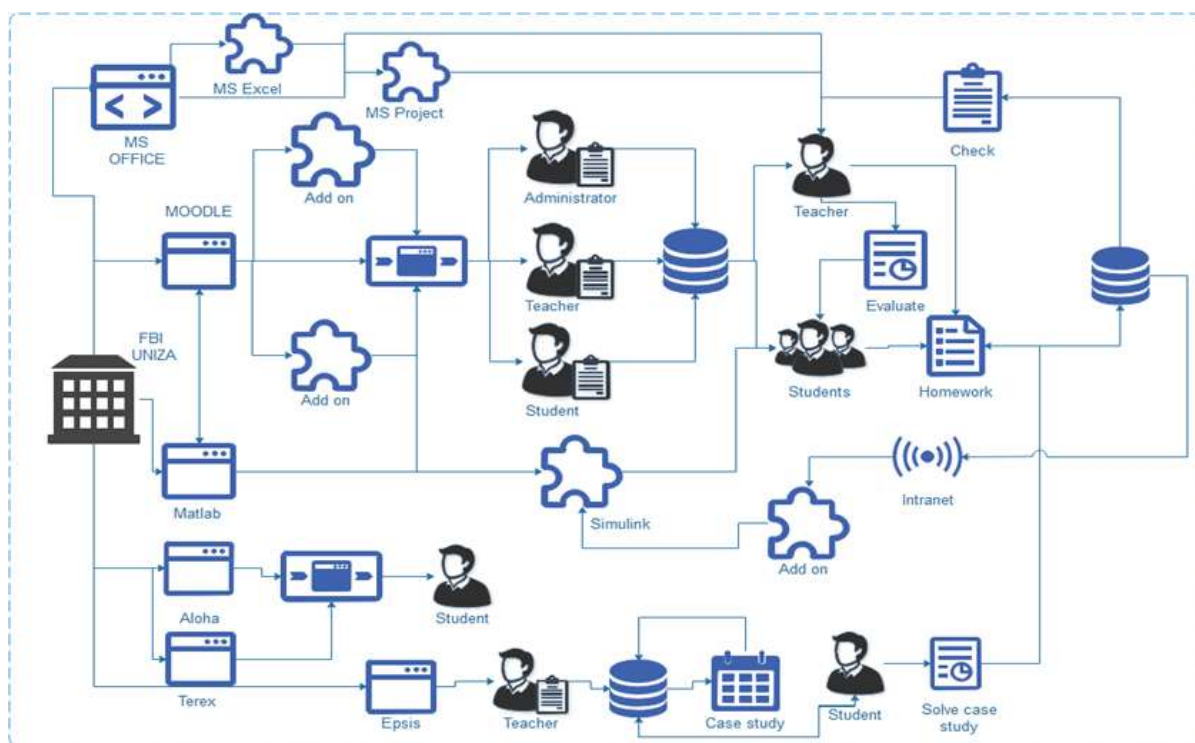


Figure 2. Links between individual software products used in the teaching process at KKM UNIZA

The use of software support in the education process is one of the current and long-term trends in teaching the various field of study at universities and colleges in over the world. The upcoming field of study Risk Management (Prevention of enterprise crises) which will be taught in the bachelor 's degree by the Department of Crisis Management of the Faculty of Security Engineering of the University of Zilina (Figure 2). Teachers at the Department of Crisis Management are and more effectively using software support in the education process. There are still general subjects that do not use software support in their study materials. In some cases, the biggest problem is the financial aspect. Licenses for selected software products are expensive. Another aspect is the lower interest on the part of teachers to involve software tools and computer technology in the teaching process, nowadays.



## 4 CONCLUSIONS

The contribution of the paper is a proposed concept of study program subjects that reflects the requirements of practice and respects global education trends. Its application will increase the quality of the educational process at the FSE UNIZA and will improve the opportunities of the graduates to find a job in Slovakia, too. The proposed solutions present a contribution for the FSE UNIZA to belong to the advanced European educational institutions through the quality of its educational process and address more potential students, too. The results of this paper are usable also for other universities with similar study programs in Slovakia and the European countries.

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