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**Iryna S. Lazarenko**

PhD, Senior Lecturer of Mathematical Modeling of Economic Systems Department  
National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”, Kyiv, Ukraine  
ORCID ID 0000-0002-3384-1186  
*irynalazar@gmail.com*

**Stanislav V. Saloid**

PhD, Associate Professor of Management Department  
National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”, Kyiv, Ukraine  
ORCID ID 0000-0002-3294-2671  
*s\_saloid@ukr.net*

**Svitlana O. Tulchynska**

Doctor of Economics, Professor, Professor of Economics and Entrepreneurship Department  
National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”, Kyiv, Ukraine  
ORCID ID 0000-0002-1409-3848  
*tuha@ukr.net*

**Sergii O. Kyrychenko**

PhD, Associate Professor, Associate Professor of Economics and Entrepreneurship Department  
National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”, Kyiv, Ukraine  
ORCID ID 0000-0001-6195-5204  
*serg191@ukr.net*

**Rostislav V. Tulchinskiy**

Doctor of Economics, Associate Professor, Professor of Management and Public Administration Department  
PHEI “Academician Yuriy Bugay International Scientific and Technical University”, Kyiv, Ukraine  
ORCID ID 0000-0003-1605-1403  
*r\_istu@ukr.net*

## NECESSITY OF IMPLEMENTATING DATA SCIENCE COURSE IN ECONOMICS CURRICULA

**Abstract.** The article describes the relevance and feasibility of implementation Data Science courses for leading economics majors: 051 Economics, 075 Marketing, 073 Management. Application of computer technology, mathematical methods and models, statistical analysis in the study process for economics students became routine long time ago, then why is Data Science linked mostly only to the faculties of information technologies? The specificity of economic professions requires the acquisition of skills in the work with large data sets, qualitative evaluation of statistics, predicting a large number of economic phenomena, so the economist of the future should be not only a specialist in the main subject area, but also a specialist in Big Data and Data Mining. The study outlines the underlying background for essential changes. The article analyzes relevant educational and professional programs, blocks of disciplines, providing qualitative assimilation of new information by students and acquisition of those abilities and skills that are needed by the modern specialist in the field of economy and will form student as a serious competitor in the labor market. It has been conducted the analysis of modern international commercial on-line courses, specifying the topics and aspects necessary for the future economics graduates. The logical scheme of Data Science specialties introduction which follows the relevant cycle of the existing disciplines of general and professional training is proposed. Mastering the knowledge of qualitative data analysis and tools for optimal work with them should be one of the main tasks of the methodological system of education and research at the faculties of economics. Modern educational technologies and scientific facilities of universities should help to expand the understanding and perception of the economist, marketologist, and manager profession, because the digital advertising, SMM, social networks, online applications, project management, *State in a Smartphone*, and other rapid transformations encourage to train not *classic* specialists, but *universals* who will be able to adapt quickly to the needs of the future.

**Keywords:** economic specialties; Data Science; Data Mining; Big Data; students of higher education institutions.

## 1. INTRODUCTION

**Problem statement.** The current trends and development of IT stimulate higher education institutions (HEI) of Ukraine to adapt programs of training specialists for the needs of today. One of the most attractive professions of the present and future is the so-called Data Scientist and Data Analyst, which is why most IT related faculties are now changing educational programs and offering training for such professionals. However, economic specialties in most cases do not hurry to make adjustments in accordance with the urgent need of the country for such specialists.

If we follow the changes that have taken place in HEIs in recent years, the implementation of Data Science disciplines has begun in *Computer Science, Systems Analysis, Applied Mathematics, Information Systems and Technologies* specialties. Commercial HEIs, most of which have authorial majors, quickly focused on the prospects of training such specialists and began not only to give courses in data analysis, but also to train directly specialists in Data Science.

In particular, the Ukrainian Catholic University owes its popularity partially thanks to that kind of programs. If we return to the economic specialties, it should be noted that there is an educational program that includes Data Science studies, it is Economic Cybernetics. In fact, it gained a lot of popularity among students for the symbiosis of mathematics, information technology and economics (as the subject of management), which made it the most "technical" among the humanitarian economic specialties. But do only students in economic cybernetics have the aptitude and the background to go deep into data science? Then why is there a growing demand for business courses, master's programs, and online training in Data Science sections among graduates of economics? HEIs must take this growing trend into account and change their approaches to training, as Ukraine faces rapidly increasing student's dissatisfaction with the learning process, outdated information and techniques, and the lack of advanced courses.

Some Ukrainian researchers substantiate the necessity and expediency of fundamental study of mathematics by future economists. In the works of H. Dutka [1], N. Samaruk [2], O. Bekh [3] the questions of importance of in-depth study of separate sections of mathematics are outlined, which not only develop logical thinking, reveal the philosophical and cognitive side of the perception of the surrounding world, but also explain the crucial applied value of the acquired knowledge, which in combination with the economic worldview creates a high class specialist, able to perform in-depth analysis of information and demonstrate exceptional skills in formalizing economic phenomena through mathematical laws.

These studies also highlight the problem of reduction of hours allocated to the course of higher mathematics. Unfortunately, this is a problem in many HEIs, which certainly limits the future opportunities of economic specialists. Studies of such scientists as N. Vasazhenko [4], S. Semerikov [5], I. Kinash [6] focus on the feasibility of combining IT and Economics, the use of modern software that forms a specialist, able to quickly find, process, transmit and store information. Most of the economic professions are related to statistical analytics, the processing of which requires knowledge in the application software. Software versions are changing rapidly, so professionals who are able to quickly adapt to a highly dynamic information space with high-quality technology will always be appreciated because time costs money, and those who know how to optimize processes and save time are indispensable for business. Cloud technology has also become popular. In studies [7], [8] and [9], the authors expose the full potential of cloud services, provide a number of popular resources in project management, for economic and mathematical modeling, in working with databases and information systems.

In the authors' opinion, the research concerning Data Science presented in sources [10] – [14] is significant for the foundation of the methodological backgrounds of the implementation of the data science courses into the educational process.

In Ukraine Data Science training is widespread through courses and meetups actively promoted by the *Data Science UA* – advisory and educational platform [15].

All these studies can certainly be attributed to the problem raised above, but they consider it one-sidedly, and we suggest that our main focus should be on the knowledge gained by students in previous courses, further improved and refined in Data Mining and Big Data areas. Actually, these two mentioned above areas do not cover all Data Science study, particularly such blocks as Deep Learning Artificial Intelligence, Computer Vision and other sections of Data Science (as these sections might be too difficult for economics students), but it can be a strategic mistake not to provide opportunities for students to master skills in the trendy and promising field of Data Science.

Programs introducing Data Science are already appearing in foreign HEIs' educational programmes, for example: at the University of Chicago [16], Erasmus University Rotterdam [17], University of California [18] and Carleton University [19].

**The purpose of the article** is substantiation of methodological foundations of introduction of Data Science disciplines, in particular, such sections as *Data Mining* and *Big Data* to the HEIs' educational process of professional training at 051 *Economics*, 075 *Marketing*, 073 *Management* specialties.

## 2. RESULTS OF THE RESEARCH

Analysis of the labor market and the demand for Big Data and Data Science professionals indicates that a large sector of the market demands particularly economically oriented professionals.

*Horizon 2020*, the program of the European Commission, gives the following definition: “Big Data – the fuel for the new digital economy” [20]. A huge amount of unstructured information is generated globally every day, which is linked to various spheres of life and stored digitally.

According to *statista.com*, the global data warehouse in 2021 will contain 2300 exabytes (1 Eb = 1 million Tb) (see Figure 1) [21].

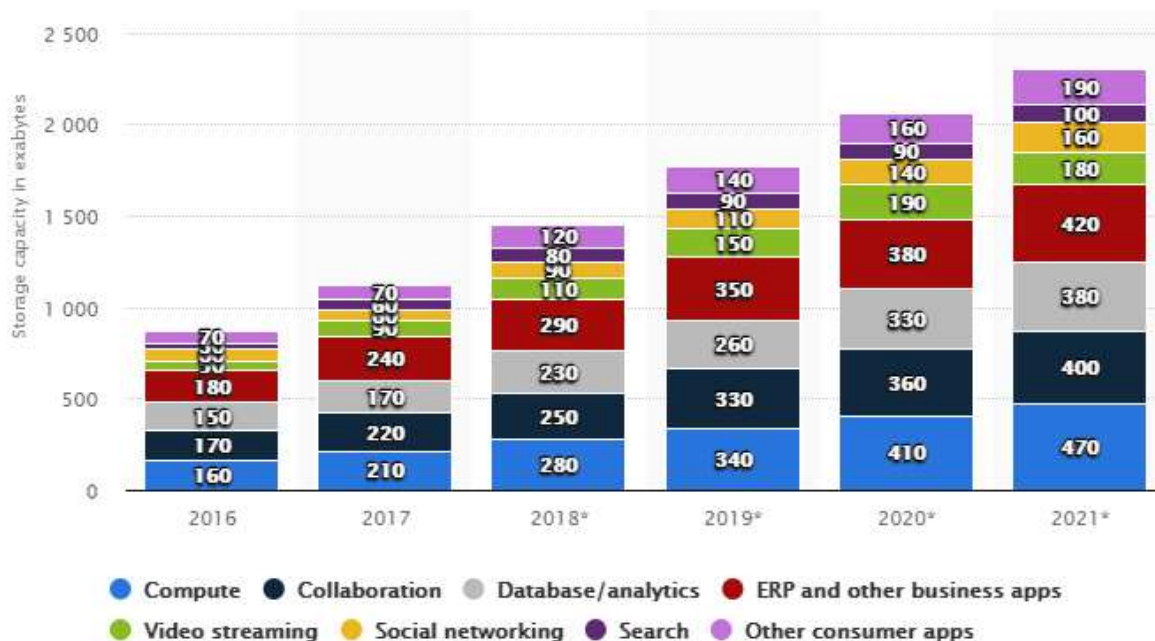
Most of the presented segments have an economic component that requires specialists of the relevant profile.

According to the McKinsey & Company consultants, there are five main ways to use Big Data in the economy [22]:

- creation of "transparent" information;
- making mathematically grounded management decisions;
- customer segmentation based on personal preferences;
- increasing the speed of decision-making through complex analytics;
- the development of the next generation of goods and services.

It is also believed that Big Data technologies will drive small and medium-sized businesses to growth, which will due to such innovations increase their profits by 60%.

The main obstacle faced by all organizations working in different sectors of the economy and which must be overcome as soon as possible is the lack of skilled professionals who are knowledgeable in the professional field and have skills in working with Big Data technologies.



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Figure 1. Segmented capacity of the World Data Warehouse from 2016 to 2021 [21].

Forecasting is one of the powerful trends in the economy, where data analysis technologies and oversized data volumes are directly applicable. Knowledge in the field of research, understanding the relationship between economic phenomena, awareness of the nature of anomalies in data is required to build forecasting models. Simple detection of analytical functional dependencies in the flow of unstructured data, relying only on the internal mathematics of the model is not enough, although, it has a strong weight in evaluating the quality of this process.

Insurance and banking are areas where the collection and careful analysis of data on a legal or physical person for issuing loans or issuing insurance indemnities requires the latest technologies and resources for the optimal functioning of the respective banking and insurance companies and for the effective assessment of the potential risks that accompany these processes.

Nowadays, one of the successful strategies of the enterprise activity is the creation of an analytical department, which increases the level of competition and, accordingly, productivity and profitability. Logistics companies save tens of millions of liters of fuel by optimizing routes. World medical institutions, when processing the patient's personal data, provide better expertise and optimal algorithm of medical support. Telecommunications companies analyze coverage, network and subscriber information on a daily basis to improve the quality of their services, all with the help of Big Data technologies.

The economy as a whole greatly benefits from the application of data analysis processes:

- reducing the risk of non-performing loans in the banking sector;
- qualitative processing of unstructured information compensates for the lack of expertise and information;
- increase of automated processes that are not affected by the human factor;
- Increasing customer satisfaction through the ability to take into account individual preferences;

- more accurate estimations by using “raw” data rather than adjusted by the person for the “desired” result.

The use of Big Data technologies in marketing allows us to better analyze consumer information, create a portrait of "your" ideal consumer, predict his/her reaction to different changes, offers, prices. Attracting similar audiences in the online and offline sectors using referral systems algorithms is one of the key technologies in such global companies as Amazon and AliExpress. Also, the assessment of the customer satisfaction level becomes more accurate, based on the analysis of the correspondence of the provided service to the expectations and needs of the clients. Analytics provide the opportunity to find new optimal ways to increase customer confidence and, as a consequence, to increase the demand for new profitable projects.

The field of management also needs specialists with deep analytics skills. Recruitment has always been based on a personal approach. However, the bandwidth of one HR specialist is very low. When it comes to recruiting new projects, there is a need for a comprehensive approach and analytics that relies on many factors of the candidate's personal, professional, communication and organizational traits. Big Data technologies allow you to test a candidate based on a wealth of information available: education, career, financial status, credit history, social networking behavior, etc.

On the other hand, the company management now has the opportunity to evaluate internal ‘weather’ in the team using the data mining algorithms: why there are changes in staffing, the probability of incorrect candidate selection strategy, the mismatch of the specialist's imagination with the real needs of companies, dissatisfaction with work processes, etc.

The latest trends in the economy are characterized by the following factors:

- the quality of information, as well as the use of advanced science and technology results, are increasingly affecting enterprise productivity and profitability;
- the tendency of transition from material production to information activity is being reviewed;
- the production process is transformed from a vertically integrated organization to a horizontally networked relationship between units;
- the economy is following the path of globalization, which, through information technology, is losing the traits of a particular nation and is “erasing” borders between countries.

Unlike natural resources, whose scarcity is an acute global problem, information resources, on the contrary, are replenished and make it possible to create better products that the world society needs [23]. Therefore, the tandem of basic and modern applied sciences in the training of future specialists should be a top priority of HEIs in further transformations. Effective work with data, the formation of a deeper understanding of processes in the economic sphere and areas that integrate into the economy - this is the challenge facing professors.

Careful analysis of the Bachelors’ educational programs and curricula in economic specialties (051 “Economics”, 075 “Marketing” and 073 “Management”) at the faculty of management and marketing of the National technical university of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute” shows that the basic disciplines relevant for *Data Mining* and *Big Data* courses are sufficiently represented in the curricula (Table 1).

We will analyze the proposals of well-known educational online services, which are the most applied for training in Data Science.

Table 1

**Academic disciplines at 051 Economics, 075 Marketing, 073 Management majors,  
preceding the study of Data Science**

<b>Specialty</b>	<b>Academic discipline</b>	<b>Number of ECTS credits</b>	<b>Semester</b>
<b>051 Economics</b>	Higher mathematics	7,5	1-2
	Probability theory and mathematical statistics	4,5	3
	Computer science	6	1-2
	Statistics	4,5	4
	Optimization methods and models	4,5	2
	Econometrics	3,5	4
	Application software (depending on educational program)	3,5-4	7-8
	Economic risks and methods of measuring them (depending on educational program)	3,5-4	5-6
	Information systems and technologies (depending on educational program)	3,5-4	4
	Predicting socio-economic processes (depending on educational program)	4-4,5	5-6
<b>075 Marketing</b>	Higher mathematics	8	1-2
	Probability theory and mathematical statistics	4,5	3
	Statistics	5	4
	Optimization methods and models	3,5	4
	Econometrics	4	5
	Fundamentals of programming	3	1
	Web design	3	2
	Information systems and technologies in marketing	3	5
	Statistical support of marketing research	4	7
	Methods of forecasting and decision making in marketing	4	6
	Digital marketing	3,5	7
<b>073 Management</b>	Higher and applied mathematics	11	1-2
	Economic statistics	4,5	2
	Information systems and technologies	3	2
	Economic forecasting	4	4
	Econometrics	3,5	7
Risk management	5	7	

Before moving on to Data Mining algorithms in resources such as Khan Academy, Coursera, edX and others, we suggest students take a few weeks to study the following courses:

- Linear algebra (vectors, vector space, actions on vectors, matrices, matrix transformations, basis, rank, eigenvalues, and systems of linear equations);

- Calculus (function of one and several variables, sequence boundary, function boundary, continuity, breakpoints, function studies and graphing, first- and second-order derivatives, derivatives rules, application of derivatives for function studies, primitives and integrals, integration rules, definite and indefinite integral, nonlinear integral, application of integrals, series, theory of differential equations);

- Theory of probability (random variable, discrete and continuous random variables, distribution function and probability density function, sum and product rules, conditional probability, basic types of statistical distributions, central limit theorem);
- Linear regression (one-factor linear regression, multifactor linear regression, coefficients of determination and correlation, nonlinear linearizing functions, hypothesis testing, statistical significance, confidence intervals construction).

All the above mentioned courses are included in the basic study disciplines, the list of which is given in Table 1: the block of linear algebra is included in the higher mathematics in the first semester, the computing block is studied in Higher Mathematics partially in the first and completely in the second semester; the theory of probability block is included in the relevant course of all specialties; the linear regression unit is covered in the course “Econometrics”.

The course of R and Python programming languages is a separate block to which online courses devote significant amount of time. Unfortunately, course of computer science doesn't pay much attention to the mentioned languages, and so far the economic data analysis is concentrated in MS Excel or sometimes using SPSS Statistics. However, computer science courses provide the basics of programming, including the study of programming languages that are MS Office oriented, such as Visual Basic or VBA (Visual Basic for Applications).

After analyzing Table 1, we can see that the core courses required to understand the data science studies are almost all concentrated in the first five semesters. Taking into account that the eighth semester of the first bachelor's degree is reduced due to undergraduate practice, it is proposed to introduce courses such as "Introduction to Data Science" in the sixth semester, and such discipline as *Big Data Technologies* in the seventh semester.

Thus, there is no objective reason not to update educational programs to prepare economics professionals toward data science.

The purpose of teaching *Introduction to Data Science* course is the formation of competencies in the students of economic specialties regarding the possibility of analyzing large amounts of information using various application packages and programming languages (R, Python), as well as forecasting the development of the object of study, taking into account non-standard management solutions; this will increase the speed of managerial decision-making through the use of complex analytics.

We offer to conduct the study of *Introduction to Data Science* discipline to prepare specialists in economic specialties, including the following topics:

1. Intro to Python:
  - 1.1. Interface, Variables, data structure;
  - 1.2. Conditional statements, loops;
  - 1.3. Functions and methods;
  - 1.4. Packages: NumPy, Pandas, SymPy;
  - 1.5. Packages: Matplotlib, Seaborn.
2. Databases:
  - 2.1. Files: reading and writing;
  - 2.2. Relational databases;
  - 2.3. SQL (Structured Query Language) queries.
3. Math and probability:
  - 3.1. Base of linear algebra: vectors, matrix;
  - 3.2. Base of calculus;
  - 3.3. Base of probability;
  - 3.4. Statistical hypothesis tests, p-value;
  - 3.5. A/B testing.

4. Intro to machine learning:
  - 4.1. Formulating of ML problem (economic, management or marketing);
  - 4.2. Base of feature engineering;
  - 4.3. Standardization, Normalization and Estimation;
  - 4.4. Model selection.
5. Supervised learning:
  - 5.1. Linear regression;
  - 5.2. Regularization (L1, L2);
  - 5.3. Logistic regression;
  - 5.4. Time series forecasting;
  - 5.5. kNN (k nearest neighbors)-algorithm;
  - 5.6. Tree-based models;
  - 5.7. SVM (Support vector machine) algorithm.
6. Unsupervised learning:
  - 6.1. k-means clustering;
  - 6.2. Hierarchical clustering;
  - 6.3. Random forest algorithm;
  - 6.4. Principal component analysis (PCA).
7. Final project, correspond with domain (economic, management or marketing).

Implementation of Introduction to Data Science course will facilitate the acquisition by the students of economic specialties of such knowledge, as:

– procedures for finding, collecting and analyzing information, calculating indicators to perform management decisions, in particular by computer modeling and processing of data, the use of numerical methods for analysis and forecasting, the study of operations and optimization methods and parallel calculations;

– regularities of functioning of socio-economic systems of different levels and spheres of activity, in particular through the use of data mining, technologies of selection and storage of information, environments and systems of high-performance computing, which Data Science allows to conduct;

– tools of effective management and business administration of entrepreneurial, foreign economic and innovative activity of enterprises, in particular by the use of semantics to extract knowledge from data, ontology, microservices, containers and API interfaces in intelligent computing, blockchain technology for distributed databases, languages search engine queries, semantic web service description languages;

– regularities of functioning of socio-economic systems of different levels and spheres of activity, in particular through the use of methods of distributed modeling of complex objects and systems in a computing environment, the use of artificial intelligence technologies in distributed computing, in particular, machine learning methods for adjusting design procedures, intellectual computing for processing of big data, basic algorithms of the intellectual analysis of undetermined as well as determined data.

Additionally, the implementation of *Introduction to Data Science* to Economics specialties students offers the following opportunities:

– first, the ability of abstract thinking, attempt and synthesis, the use of the results of the data obtained as a result of calculation of large-scale computational tasks in distributed intellectual environment with possibility to control the data processing by using special software;

– secondly, the ability to apply information and communication technologies, in particular the use of modern information systems and technologies for various purposes, distributed grid and cloud computing, cloud-based data warehousing, service-oriented computing and architectures,



nebulous computing, context-controlled adaptive computing, serverless adaptive computing calculations, selection and implementation of computer aided design;

– thirdly, the ability to analyze the results of the company activity, compare them with the factors of influence of the external and internal environment, as well as the ability to find new market opportunities, formulate innovative business ideas, develop projects and ensure their implementation, in particular, through the design and implementation of computer-aided processing methods for large-scale data in a variety of applications, business process management systems, Internet networks, service-oriented environments, and high-performance cluster computing systems.

Like any other discipline, *Introduction to Data Science* subject gives students certain capabilities, in particular:

– demonstrate the skills of identifying problematic links in the organization's management and substantiation of management decisions aimed at optimizing them, for example results of processing the obtained data, analyzing and comprehending them, presenting the results of work and substantiating the proposed solutions at a high scientific, technical and professional level;

– describe the content of the functional areas of the organization, including the management of industrial enterprise, in particular as a result of the use of semantic methods and semantic web services to create cloud applications in various application areas, use of intelligent data processing software and estimating data parameters, creating ontologies, building microservices, selecting data processing algorithms to accomplish the task;

– demonstrate skills of independent work, flexible thinking, openness to new knowledge, in particular through the application of computer simulation and data processing software in a cloud environment, methods of distributed modeling of complex objects and systems, the use of artificial intelligence technologies in distributed computing, including machine learning methods to optimize project procedures, intelligent computing to process big data.

A series of the *Data Science Bootcamp* trainings from the American company Integrated Technology Laboratory LLC (Intela) was held at the National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute” with the aim of improving the skills of teaching staff and scientists from different regions of Ukraine in the field of data mining, which was aimed at different specialists. The purpose of these trainings was to introduce data analysis for students of different specialties, since this area is not restricted to IT sphere only. US scientists understand the importance of awareness in data analysis and that high-quality specialists well-equipped with Data Science will be in demand and highly paid at the labor market.

The process of transforming Ukraine's modern education system highlights also the issue of retraining of teaching staff ready to pass on the acquired knowledge to future generations, so the appropriate courses for academic staff are in great demand.

### 3. CONCLUSIONS AND PROSPECTS OF FURTHER RESEARCH

Thus, the main vector of changes in the preparation of an expert in the economic profile should be the introduction of disciplines for data mining and technologies of working with large amounts of information. Taking as an example the western HEIs, the huge demand from students in online schools and courses, focusing on the performance of leading companies which have improved their positions and ranks by implementing modern data analysis technologies and growing their own specialists in this field, HEIs should change the traditional views on training of the specialists in economic activity and provide more up-to-date knowledge in working with data, analytical methods, technological techniques, principles of modeling and in-depth analysis.

The scientific novelty of the research is to develop methodological principles for the implementation of the Data Science course in the educational process of training specialists of the first (bachelor) level of higher education in economic specialties, based on:

- market demand in highly skilled marketologists, managers, analysts in insurance, banking and other activities with knowledge in Big Data and Data Science;

- conducted analysis of existing curriculum programs on the example of 051 *Economics*, 075 *Marketing* and 073 *Management* specialties at the National technical university of Ukraine “Igor Sikorsky Kyiv polytechnic institute”, which gave the opportunity on the basis of comparison with educational on-line courses in “Data Science” to determine the possibility of implementing courses on studying Data Science in the curriculum programs.

It is suggested that the courses for specialists of the first higher education level of 051 *Economics*, 075 *Marketing* and 073 *Management* specialties: *Introduction to Data Science* in the sixth semester, *Big Data Technologies* should be studied in the seventh semester, which will enhance the competitiveness of such specialists in economic specialties at the market. Knowledge, competences and skills gained in the field of Data Science and Big Data will enable future specialists to make economically grounded decisions more quickly, to analyze the current situation, to build the projected trends of economic phenomena and processes, evaluate the potential risks of economic activity and more.

The issues of professional qualification of teachers, conducting relevant trainings and retraining courses for the faculties of higher education institutions in order to ensure proper quality teaching of *Introduction to Data Science* and *Big Data Technologies* courses are the subject of the further scientific research.

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## НЕОБХІДНІСТЬ УПРОВАДЖЕННЯ ДИСЦИПЛІН З DATA SCIENCE ДЛЯ ЕКОНОМІЧНИХ СПЕЦІАЛЬНОСТЕЙ

### **Лазаренко Ірина Сергіївна**

кандидат фізико-математичних наук,  
старший викладач кафедри математичного моделювання економічних систем  
Національний технічний університет України «Київський політехнічний інститут імені Ігоря Сікорського», м. Київ, Україна  
ORCID ID 0000-0002-3384-1186  
[irynalazar@gmail.com](mailto:irynalazar@gmail.com)

### **Салоїд Станіслав Васильович**

кандидат економічних наук, доцент кафедри менеджменту  
Національний технічний університет України «Київський політехнічний інститут імені Ігоря Сікорського», м. Київ, Україна  
ORCID ID 0000-0002-3294-2671  
[s\\_saloid@ukr.net](mailto:s_saloid@ukr.net)

### **Тульчинська Світлана Олександрівна**

доктор економічних наук, професорка кафедри економіки і підприємництва  
Національний технічний університет України «Київський політехнічний інститут імені Ігоря Сікорського», м. Київ, Україна  
ORCID ID 0000-0002-1409-3848  
[tuha@ukr.net](mailto:tuha@ukr.net)

**Кириченко Сергій Олександрович**

кандидат економічних наук, доцент, доцент кафедри економіки і підприємництва  
Національний технічний університет України «Київський політехнічний інститут імені Ігоря  
Сікорського», м. Київ, Україна  
ORCID ID 0000-0001-6195-5204  
*serg191@ukr.net*

**Тульчинський Ростислав Володимирович**

доктор економічних наук, доцент, завідувач кафедри менеджменту та публічного адміністрування  
ПВНЗ «Міжнародний науково-технічний університет імені академіка Юрія Бугая», м. Київ, Україна  
ORCID ID 0000-0003-1605-1403  
*r\_istu@ukr.net*

**Анотація.** У статті представлена актуальність та доцільність упровадження дисциплін з Data Science для провідних економічних спеціальностей 051 «Економіка», 075 «Маркетинг», 073 «Менеджмент». Застосування комп'ютерних технологій, використання математичних методів та моделей, проведення статистичного аналізу даних давно вже є буденністю в процесі навчання для студентів економічного спрямування, тоді чому Data Science пов'язують в більшості випадків з факультетами з інформаційних технологій? Специфіка економічних професій зобов'язує здобувати навички в роботі з великими масивами даних, якісно оцінювати статистичні показники, прогнозувати велику кількість економічних явищ, тому економіст майбутнього має бути не тільки фахівцем у предметній галузі, а й спеціалістом в Big Data та Data Mining. Дане дослідження висвітлює підґрунтя для відповідних змін. Проаналізовано відповідні освітньо-професійні програми, блоки дисциплін, що дають можливість для якісного засвоєння нової інформації студентами та набуття тих здатностей та вмінь, які необхідні сучасному фахівцю в галузі економіки та сформують його як серйозного конкурента на ринку праці. Проведено аналіз сучасних міжнародних комерційних онлайн курсів та висвітлено ті теми та аспекти, які необхідні для майбутнього випускника економічного спрямування. Запропоновано логічну схему впровадження напрямку Data Science, що наслідую відповідний цикл наявних дисциплін загальної та професійної підготовки. Оволодіння студентами знаннями якісного аналізу даних та інструментарію оптимальної роботи з ними має бути однією з основних задач методичної системи навчання та наукового напрямку на економічних факультетах. Сучасні освітні технології та наукові бази університетів мають допомогти студентам у розширенні світогляду і сприйнятті професій економіста, маркетолога та менеджера, оскільки цифрова реклама, SMM, соціальні мережі, онлайн додатки, управління проектами, «держава в смартфоні» та інші стрімкі трансформації спонукають готувати не «класичних» фахівців, а універсалів, які будуть мати змогу швидко пристосовуватись до потреб майбутнього.

**Ключові слова:** економічні спеціальності; Data Science; Data Mining; Big Data; студенти закладів вищої освіти.

## НЕОБХОДИМОСТЬ ВНЕДРЕНИЯ ДИСЦИПЛИНЫ DATA SCIENCE ДЛЯ ЭКОНОМИЧЕСКИХ СПЕЦИАЛЬНОСТЕЙ

**Лазаренко Ирина Сергеевна**

кандидат физико-математических наук,  
старший преподаватель кафедры математического моделирования экономических систем  
Национальный технический университет Украины «Киевский политехнический институт имени Игоря  
Сикорского», г. Киев, Украина  
ORCID ID 0000-0002-3384-1186  
*irynalazar@gmail.com*

**Салоид Станислав Васильевич**

кандидат экономических наук, доцент кафедры менеджмента  
Национальный технический университет Украины «Киевский политехнический институт имени Игоря  
Сикорского», г. Киев, Украина  
ORCID ID 0000-0002-3294-2671  
*s\_saloid@ukr.net*

**Тульчинская Светлана Александровна**

доктор экономических наук, профессор, профессор кафедры экономики и предпринимательства  
Национальный технический университет Украины «Киевский политехнический институт имени Игоря  
Сикорского», г. Киев, Украина  
ORCID ID 0000-0002-1409-3848  
*tuha@ukr.net*

**Кириченко Сергей Александрович**

кандидат экономических наук, доцент, доцент кафедры экономики и предпринимательства  
Национальный технический университет Украины «Киевский политехнический институт имени Игоря  
Сикорского», г. Киев, Украина  
ORCID ID 0000-0001-6195-5204  
*serg191@ukr.net*

**Тульчинский Ростислав Владимирович**

доктор экономических наук, доцент,  
заведующий кафедрой менеджмента и публичного администрирования  
ПВНЗ «Международный научно-технический университет имени академика Юрия Бугая», г. Киев, Украина  
ORCID ID 0000-0003-1605-1403  
*r\_istu@ukr.net*

**Аннотация.** В статье приведены актуальность и целесообразность внедрения дисциплин по Data Science для ведущих экономических специальностей 051 «Экономика», 075 «Маркетинг», 073 «Менеджмент». Применение компьютерных технологий, использование математических методов и моделей, проведение статистического анализа данных давно уже является обыденностью в процессе обучения студентов экономического направления, тогда почему Data Science связывают в большинстве случаев с факультетами по информационным технологиям? Специфика экономических профессий обязывает приобрести навыки в работе с большими массивами данных, качественно оценивать статистические показатели, прогнозировать большое количество экономических явлений, поэтому экономист будущего должно быть не только специалистом в предметной области, а и специалистом в Big Data и Data Mining. Данное исследование освещает основы для соответствующих изменений. Проанализированы соответствующие образовательно-профессиональные программы, блоки дисциплин, дающих возможность для качественного усвоения новой информации студентами и приобретения тех способностей и умений, которые необходимы современному специалисту в области экономики и сформируют его как серьезного конкурента на рынке труда. Проведен анализ современных международных коммерческих онлайн курсов и освещены те темы и аспекты, которые необходимы для будущего выпускника экономического направления. Предложено логическую схему внедрения направления Data Science, которое наследует соответствующий цикл имеющихся дисциплин общей и профессиональной подготовки. Овладение студентами знаниями анализа данных и инструментарием оптимальной работы с ними должно быть одной из основных задач методической системы обучения и научного направления на экономических факультетах. Современные образовательные технологии и научные базы университетов должны помочь студентам в расширении мировоззрения и восприятии профессий экономиста, маркетолога и менеджера, поскольку цифровая реклама, SMM, социальные сети, онлайн приложения, управление проектами, «государство в смартфоне» и другие стремительные трансформации побуждают готовить не «классических» специалистов, а универсалов, которые будут иметь возможность быстро приспосабливаться к потребностям будущего.

**Ключевые слова:** экономические специальности; Data Science; Data Mining; Big Data; студенты высших учебных заведений.

