



**Business
Analytics Skills
for the Future-
proof Supply
Chains**

**CHECKING A
CURRICULUMS
AND STUDY
PROGRAMS
OF LOGISTICS
FIELDS IN
HIGH RANKED
WORLD
UNIVERSITIES
IN TERMS OF
USING BI IN
LOGISTICS**

BAS4SC Project Team



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Introduction & Methodology

The main goal of the research was to identify the current status of business analytics subjects in the curriculums of the different faculties which deal with logistics & supply chain management. Also, the research included identifying the best practices, patterns, gaps, and opportunities in different Faculties and observed regions. The final aim was to provide a clear picture of the current situation in an observed field, which will serve as a stepping stone for proposing different subjects for enhancing knowledge in a given topic.

The methodology of the research consisted of reviewing the publicly available curriculums from different study programs. The focus of the research was on study programs which were studied at: technical faculties, mechanical faculties, traffic faculties, economics faculties, business and management faculties and applied sciences faculties. All study programs that contained the words logistics or SCM in the name were automatically included in the analysis, and within them, logistics courses and courses related to business process analytics were separated.

Study programs that did not contain the words logistics or SCM in the title were reviewed, and if they had logistics courses, courses related to SCA were also selected. Otherwise, if they had courses related to SCA and did not contain logistics courses, such study programs were not included in the further analysis.



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Tables 2-6 present the names of universities whose business analytics programs were analyzed, divided into project partners.

Table 2. Universities analyzed by PUT

University
Ludwig-Maximilians-Universität München
Georg-August-Universität Göttingen
IU International University of Applied Sciences
International School of Management (ISM)
University of Tartu
Tallinn University
TTK University of Applied Sciences
Škoda Auto University
Tomas Bata University in Zlín
University of Žilina
Gdansk University of Technology
Poznan University of Technology
SGH Warsaw School of Economics
WSB University Gdańsk
University of Logistics
Vilnius University
Kaunas University of Technology
Vytautas Magnus University
University of Latvia
University of Applied Science

Source: Own study

Table 3. Universities analyzed by PSL

University
Boston University
University of Pittsburgh
University of Miami
University of Bradford
University of Southampton
Worcester Polytechnic Institute
La Salle University

Source: Own study



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Table 4. Universities analyzed by EFOS

University
Universitat Pompeu Fabra Barcelona (Spain), Faculty of Economics and Business
Josip Juraj Strossmayer University of Osijek (Croatia), Faculty of Economic in Osijek
Széchenyi István university of Gyor (Hungary), Kautz Gyula Faculty of Business and Economics
Rennes School of Business
EMLV Business School in Paris
Montpellier Business School
Erasmus School of Economics Rotterdam
University of Amsterdam
Antwerp Management School
United International Business Schools
University of Applied Sciences and Arts

Source: Own study

Table 5. Universities analyzed by UNS

University
University of Economics – Varna
Athens University of Economics and Business
University of Thessaly
University of Patras
University St Cirilo i Metodije, Skopje
University St Kliment Ohridski, Bitola
Univerzitet „Goce Delčev“ Štip
Politehnica University of Bucharest
Epoka Universita
Univerzitet u Istočnom Sarajevu
Univerzitet u Rijeci
Univerzitet u Zagrebu
Univerzitet Crne Gore
FSKL, Budva
Univerzitet u Novom Sadu
Univerzitet u Beogradu
Univerzitet u Nišu

Source: Own study

Table 6. Universities analyzed by UM



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University
Norwegian University of Science and Technology (Norway)
Molde University College (Norway)
KTH Royal Institute of Technology (Sweden)
University of Stockholm, Stockholm School of Economics (Sweden)
Chalmers University of Technology (Sweden)
Technical University of Denmark (Denmark)
University of Southern Denmark (Denmark)
Lappeenranta-Lahti University of Technology LUT (Finland)
University of Vaasa (Finland)
University of Maribor, Faculty of Logistics (Slovenia)
University of Ljubljana, School of Economics and Business (Slovenia)

Source: Own study



2. Analysis of educational programs from Central and Eastern Europe

2.1. General information

First analysis refers to the study programmes of universities operating in Poland. There are 369 of them, including: 131 public, 221 non-public and 17 ecclesiastical. All HEIs follow the Bologna process of study, but in a different arrangement of semester years: for bachelor's studies – 6 semesters, for engineering studies – 7 semesters, and for master's studies – 3 or 4 semesters.

Second analysis concern of Lithuania. There are 23 universities in Lithuania (14 of them are public, 8 are private, and one is a branch of a Polish university). On average, a bachelor's degree in Lithuania lasts four years. You need to obtain at least 140-180 credits. The volume of study in a master's program is 90-120 credits. On average, studies last up to 2 years. The curriculum depends on the university, but usually includes ten subjects (6 credits each) and a master's thesis (30 credits).

Third analysis is for Latvia Universities. The higher education system of Latvia is represented by 46 universities with 503 study programs. In addition 301 Bachelor programs at 44 universities and 156 Master programs at 30 universities. Latvian universities follow the Bologna system, offering three levels of study (bachelor's, master's and PhD). Most bachelor degrees take three or four years to complete, while master's degrees are one or two years long.

In Germany, can choose between different state and private higher education institutions. More than 400 state-recognised institutions of higher education can be found across Germany. Together, they offer some 20,000 different study programmes. Universities in Germany have a classic arrangement of faculties (economics, business, applied mathematics) and fields of study. The standard period of study is usually 3 years (6 semesters, with 180 ECTS points) for bachelor's degrees and 2 years (4 semesters, 120 ECTS) for master's degrees.



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There are two research centers in Estonia (Tartu and Talin). The centers teach and focus on general education, but also on the digitization of business. There are 20 universities in Estonia, including 6 public universities and 1 private one.

Estonian higher education has two cycles, following the Anglo-Saxon bachelor–master model. The standard volume of Bachelor's study as well as of professional higher education study is 180–240 ECTS. The standard period of Master's study is 60–120 ECTS. The standard period of Bachelor's and Master's study combined must be at least 300 ECTS in total. The standard period of Doctoral study is 180–240 ECTS.

The presented analysis of study programs of various universities includes universities from the Czech Republic and Slovakia. In total, 26 universities (including 20 from the Czech Republic and 6 from Slovakia) and 74 faculties were reviewed, from which 5 faculties closely related to the subject of the project were selected.

Regarding the duration of studies in the countries mentioned above, bachelor's studies last 3 or 3.5 years (6 or 7 semesters), while master's studies usually last 2 years.

A short overview of the reviewed universities/ /faculties/fields of study is presented in the table below.



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Table 7. Summary of reviewed HEI in CEE

	State	Total number of reviewed Universities	Total number of reviewed faculties	Extracted faculties with a project topic	System of higher education (bachelor + master in years)
1	Poland	5	18	9	3 or 3,5 B; 1,5 or 2 M
2	Lithuania	3	6	5	4 B; 2 M
3	Latvia	2	2	2	3 or 4 B; 1 or 2 M
4	Germany	4	17	6	3+2
5	Estonia	3	3	1	3+2
6	Czech Republic	2	20	4 (related to logistics) 16 (related to business analysis, management, economics, mathematics, information technology)	3-3,5+1,5-2
7	Slovakia	1	17	1 (related to logistics) 6 (related to business analysis, management, economics, mathematics, information technology)	3+2
	Sum	20	83		

Source: Own study

2.2. Curriculums and competencies

The review of the curriculum's provided in different study programs revealed that there is a notable presence of classical traditional teaching techniques and lacking of new advanced teaching techniques and procedures. Accordingly, faculties use the classical teaching approach which can be described as: teaching in classrooms, student consultations, workshops, student exchange, internships, etc. As highlighted, there is lacking of modern approaches and tools like: interactive tables, online teaching courses, online interactive teaching materials which enable testing of different models/assumptions by students, solving real case studies in a BAS, playing serious business and BAS games, etc.



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Table 8. Business analytical skills for CEE

State	University/Faculty Field of study	Level of study ¹	Logistics knowledge ²	Business Analytics knowledge	General & supporting knowledge ³
Poland	University of Warsaw, Faculty of Economic Sciences Data Science and Business Analytics http://informatorects.uw.edu.pl/pl/programmes-all/DSBA-PRK/S2-PRK-DSBA/	M	5%	40%	55%
	Warsaw University of Technology, Faculty of Management Management Engineering https://www.wz.pw.edu.pl/Studia/Siatki-studiow/Siatki-studiow-rok-akademicki-2022-2023	M D	20%	10%	70%
	Warsaw University of Technology, Faculty of Management Management https://www.wz.pw.edu.pl/Studia/Siatki-studiow/Siatki-studiow-rok-akademicki-2022-2023	B	20%	10%	70%
	Adam Mickiewicz University, Faculty of Mathematics and Computer Science Data Analysis and Processing https://wmi.amu.edu.pl/dla-kandydata/studia-ii-stopnia/analiza-i-przetwarzanie-danych	M	5%	40%	55%
	Gdansk University of Technology, Faculty of Management and Economics Economic Analysis https://pg.edu.pl/biuletyn-informacji-publicznej/wydzial-zarzadzania-i-ekonomii	M	5%	40%	55%
	Gdansk University of Technology, Faculty of Management and Economics Management	B	20%	10%	70%

¹ (B bachelor; M – master)

² (technical and managerial)

³ (mathematics, management, economics, etc)



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	https://pg.edu.pl/biuletyn-informacji-publicznej/wydzial-zarzadzania-i-ekonomii				
	Wrocław University of Technology, Faculty of Management Management Engineering https://rekrutacja.pwr.edu.pl/wyszukiwarka-kierunkow-studiow/inzynieria-zarzadzania/	M B	20%	10%	70%
	Łódź University of Technology, Faculty of Organisation and Management Logistics https://programy.p.lodz.pl/ectslabel-web/kierunekSiatkaV4.jsp?l=pl&w=logistyka&pkId=1632&p=7347&stopien=studia%20pierwszego%20stopnia&tryb=studia%20stacjonarne&v=4#	B	50%	10%	40%
	Silesian University of Technology, Faculty of Organisation and Management Business analytics https://bip.polsl.pl/programy-studiow/	M B	5%	40%	55%
	Poznan University of Technology, Faculty of Engineering Management Logistics https://put.poznan.pl/karty-ects/20222023	M B	50%	10%	40%
	Poznan School of Logistics Logistics https://wsl.com.pl/pl/	B	50%	10%	40%
Lithuania	Vilnius University, Faculty of Economics and Business Administration Management https://www.vu.lt/en/studies/bachelor-and-integrated-studies/management#programme-structure	B	20%	10%	70%
	Vilnius University, Faculty of Economics and Business Administration Economic Analytics https://www.vu.lt/en/studies/master-studies/economic-analytics#programme-structure	M	5%	40%	55%



	Vilnius University, Faculty of Mathematics and Informatics Data Science https://www.vu.lt/en/studies/master-studies/data-science#programme-structure	M	5%	40%	55%
	Kaunas University of Technology, School of Economics and Business Business Digitalization Management https://admissions.ktu.edu/programme/b-business-digitalization-management/	B	20%	20%	60%
	Kaunas University of Technology, Faculty of Social Sciences, Arts and Humanities Communication Studies and Information Management Technologies https://admissions.ktu.edu/programme/b-communication-studies-and-information-management-technologies/	B	5%	30%	65%
	Vytautas Magnus University Business Logistics https://www.vdu.lt/en/study/program/overview/311/	M	50%	10%	40%
	Vytautas Magnus University Logistics and Commerce https://www.vdu.lt/en/study/program/show/299/	M	50%	10%	40%
Latvia	RISEBA University of Applied Sciences Big data analysis https://www.riseba.lv/en/students/postgraduate-studies/big-data-analytics	M	5%	40%	55%
	University of Latvia Business and Data Analysis https://www.lumic.lu.lv/en/baltic-digital-skills-development-programme/digital-skills-development-programme-2021-2022/module-i-business-and-data-analysis/	Course	5%	85%	10%
Czech Republic	Skoda Auto University-International Supply Chain Management https://is.savs.cz/katalog/plany.pl?fakulta=10;poc_obdobi=145;misto_vyuky=1;typ_ss=;ty	M	5 (21%)	7 (29%)	12 (50%)



	<p>p_studia=4;program=184;obor=-2;specializace=-2;new_spec=23;podprogram=;forma=1;stud_plan=1593;lang=en&_gl=1*13zwuj2*_ga*MTA3NzU5MTgzNS4xNjY4NzMOODkz*_ga_3X43WJW3XN*MTY2OTIzNzkxOC42LjEuMTY2OTIzODE3Mi42MC4wLjA.&_ga=2.28144764.1192646300.1669221474-1077591835.1668734893</p>				
	<p>Skoda Auto University-Logistics and Quality Management</p> <p>https://is.savs.cz/katalog/plany.pl?fakulta=10;poc_obdobi=145;misto_vyuky=1;typ_ss=;ty_p_studia=1;program=182;obor=-2;specializace=-2;new_spec=82;podprogram=;forma=1;stud_plan=1620;lang=en&_gl=1*s8yta9*_ga*MTA3NzU5MTgzNS4xNjY4NzMOODkz*_ga_3X43WJW3XN*MTY2OTIyNjQwMy41LjEuMTY2OTIyNjQ2My42MC4wLjA.&_ga=2.233626718.1192646300.1669221474-1077591835.1668734893</p>	B	4 (10%)	10 (25%)	26 (65%)
	<p>Tomas Bata University in Zlín-Faculty of Logistics and Crisis Management-Department of Logistics-Field: Applied Logistics</p> <p>https://flkr.utb.cz/o-fakulte/ https://flkr.utb.cz/o-fakulte/zakladni-informace/struktura/ustavy/ustav-logistiky/studium-2/bakalarske-studium/</p>	B	4 (31%)	1 (8%)	8 (61%)
	<p>Tomas Bata University in Zlín-Faculty of Logistics and Crisis Management-Specialization: Security of Logistic Systems</p> <p>https://www.utb.cz/en/vyhledavac-oboru/societal-security-mgr/security-of-logistic-systems-mgr/ https://stag.utb.cz/ects/plan/10502?lang=en</p>	M	6 (19%)	3 (10%)	23 (71%)
Slovakia	<p>University of Žilina - Faculty of Operation and Economics of Transport and Communication-Field: Forwarding and Logistics</p> <p>https://fpedas.uniza.sk/en/Vzdelavanie(uniza.sk) https://www.uniza.sk/index.php/en/studijne-programy-en?oblast=9</p>	B	8 (15%)	8 (15%)	38 (70%)
	<p>University of Žilina - Faculty of Operation and Economics of Transport and Communication-Field: Forwarding and Logistics</p> <p>https://fpedas.uniza.sk/en/Vzdelavanie(uniza.sk) https://www.uniza.sk/index.php/en/studijne-programy-en?oblast=9</p>	M	7 (27%)	6 (23%)	13 (50%)



	University of Žilina - Faculty of Operation and Economics of Transport and Communication- Field: Distribution Technologies and Services	B	6 (10%)	19 (33%)	33 (57%)
Germany	Ludwig-Maximilians-Universität München https://www.m-datascience.mathematik-informatik-statistik.uni-muenchen.de/index.html	M	0	9 (60%)	6 (40%)
	Georg-August-Universität Göttingen https://www.uni-goettingen.de/	M	0	7 (37%)	12 (63%)
	IU International University of Applied Sciences	B	10 (17%)	20 (35%)	28 (42%)
	International School of Management (ISM) https://ism.de/studium-vollzeit/master/business-intelligence-studium/studienablauf?highlight=WyJidXNpbmVzcyIsImFuYWx5dGljcyIsIm1vZHVzZSIsImJ1c2luZXNzIGFuYWx5dGljcyIsImJ1c2luZXNzIGFuYWx5dGljcyBtb2R1bGUiLCJhbmFseXRpY3MgbW9kdWxlll0=#2-semester	M	2 (22%)	3 (33%)	4 (44%)
Estonia	University of Tartu	M	0	8 (42%)	11 (58%)
	Tallinn University	M	2 (14%)	3 (21%)	9 (65%)
	TTK University of Applied Sciences https://www.ttk.ee/studies/bachelor-studies-in-estonian/?lang=en	B	6 (50%)	3 (25%)	3 (25%)

Source: Own study

Table 9 presents a summary of the most important competencies related to business analytics in the area of supply chains identified at this stage of the analysis.



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Table 9. Business analytical skills for CEE

Managerial skills	Mathematical – informatics skills
Best practices of Logistics Big Data Management Systems Business Process Management Concepts and methods in business analysis Concepts of Logistics Data Management Data Security Management Databases for Logistics Enterprise Resource Planning Systems (ERP) Information Systems in Management Management Measuring the efficiency of business systems and processes Operations Management Problem solving Strategic Management	Artificial Intelligence in Business Big Data Research Methods Big Data Systems Blockchain Technologies Business Analytics Applications Business Data Analytics Business Intelligence Business process optimization Content analysis in the era of new media and Big Data Data analysis and R software package Data batch processing Data mining Data protection Data Visualisation Methods Decomposition of complex problem Designing the databases Discovering regularities in data Forecasting Techniques Inference fuzzy Latent Dirichlet Allocation algorithm Latent Semantic Analysis Linear Regression with Single and Multiple Regressors Methods for Business Decision Making Multinomial Logistics Regression Model Multivariate analysis Optimization Methods and Tools Problem in the world of Big Data Qualitative data analysis: codes and coding R for statistical computing and graphics Simulation models Simulation of Logistics and Supply Chains Social Network Analysis Software tools for data management Software tools in logistics Statistics Statistics for Business Analytics Time Series Regression and Forecasting
<ul style="list-style-type: none"> - Production System -analysis of its state -Operational and tactical Management - Strategic Logistics Management - Production Management -Management and planning of production - Project Management- 	<ul style="list-style-type: none"> - Production Logistics -computer simulation -Applying simulation -Computer simulation software -Modelling process - Computer simulation- principles - Simulation game-interpretation its final results



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<p>apply basic tools</p> <ul style="list-style-type: none"> - Project Management - explaining the core of its key principles - Business project plan- preparing - Strategic decisions- analysis their causes and impacts - Logistics strategies -Logistics management - Green logistics system - Supply chain management concepts - Logistics systems - Production processes-optimization - Logistic functions, - Supply Chain Strategic Management - Supply Chain functions - Supply Chain processes - Enterprise management - Organization, Management and Production Planning- applying methods - Production Systems - Risks in the Logistics Chain- suitable methods for its identifying and assessing - Project Risk and Cost Management - Sales and Sales Logistics, - Logistics in supply, - Process Analysis - Storage and Production - Transport logistics - Distribution Management - Logistics Activities in crisis situations - Quality Management of Logistics - Data Management - Operations Management - Project and Process Management 	<ul style="list-style-type: none"> - conceptual Database Schema in the E-R model- its constructing - Mathematics & Statistics - Database Management - conceptual Database Schema- its transformation into a relational data model - SQL-construction of simple queries - Business Process Modeling -multimensonal Data Model - Data Analysis (obtained from the real production system) - Advanced Mathematics for Decision Making - Mathematical Modeling to design of Production Systems - Data Mining - Business Process Optimization - Computer Experiments with a Simulation Model for the Optimization of Processes in Production and Logistics Systems - Optimization models and heuristic methods for Managing Production Systems - Probability of occurrence and impact of risk on the company's logistics- calculations
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Source: Own study



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3. Analysis of educational programs from UK and USA

3.1. General information

In this analysis of the study curriculum's of the different HEI the region taken into consideration in the area of the USA and UK. In total, we have review the 7 universities and 130 faculties and we selected 7 faculties with the topics issue. At some selected faculties, there are one or more study programs with the topic, as shown in Chapter 3 of this report.

Generally, all the countries are following the Bologna study process but with different arrangements of the study years: for bachelor's studies 3 or 4 years and for master's studies 1,5 or 2 or 3 or 4 years. A short overview of the reviewed universities/faculties by country is given in the table below

Table 10. Summary of reviewed HEI in United States of America and United Kingdom

	State	Total number of reviewed Universities	Total number of reviewed faculties	Extracted faculties with a project topic	System of higher education (bachelor + master in years)
1	United States of America	5	121	5	3-4+1,5-2
2	United Kingdom	2	9	2	3+4
	Sum	7	130	7	

Source: Own study

3.2. Curriculums and competencies

A review of the curricula provided in the various study programs showed that there is a noticeable presence of classic traditional teaching techniques in every course but also a lack of new advanced teaching techniques and procedures can be noticeable in some of them. Some of the courses are offered online, while others are delivered on-campus. At Universities located in USA not only online courses offer a wide range of materials adapted to asynchronous learning. Students can benefit from advanced pedagogy and the latest digital-learning concepts introduced in the online environment, such as video conferencing, live lectures and seminars, proctored assessments,



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access to proprietary software applications within virtual labs and cloud servers/technologies, creative learning, teamwork, and competitive games offered with the help of advanced business simulations. Students can also benefit from Projects executed in global companies. In UK didactical approach is rather traditional but still it seems to be complete. Students also visits global companies and absorb a lot of experience from group projects and simulations labs. Didactic materials are also available online.

Table 11. Summary of reviewed HEI in United States of America and United Kingdom

State	University/Faculty	Level of study ⁴	Logistics knowledge ⁵	Business Analytics knowledge	General & supporting knowledge ⁶
USA	Boston University – Department of Mathematics & Statistics https://www.bu.edu/academics/grs/departments/mathematics-statistics/	M	5 (25%)	7 (35%)	8 (40%)
	University of Pittsburgh – Department of Statistics https://www.stat.pitt.edu	M	6 (26,1%)	11 (47,8%)	6 (26,1%)
	University of Miami – Miami Herbert Business School https://events.miami.edu/department/miamiherbert	B	10 (31,3%)	9 (28,1%)	13 (40,6%)
	Worcester Polytechnic Institute – The Business School https://www.wpi.edu/academics/business	M	7 (28%)	9 (36%)	9 (36%)
	La Salle University – Department of Mathematics and Statistics https://www.dlsu.edu.ph/colle	M	5 (45,4%)	3 (27,3%)	3 (27,3%)

⁴ (B bachelor; M – master)

⁵ (technical and managerial)

⁶ (mathematics, management, economics, etc.)



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	ges/cos/departments/mathematics/				
UK	University of Bradford – Faculty of Engineering and Informatics https://www.bradford.ac.uk/ei/	M	3 (21,4%)	2 (14,3%)	9 (64,3%)
	University of Southampton – Southampton Business School https://www.southampton.ac.uk/study/subjects/business-accounting-finance-marketing	M	7 (43,8%)	3 (18,7%)	6 (37,5%)

Source: Own study

Table 12 presents a summary of the most important competencies related to business analytics in the area of supply chains identified at this stage of the analysis.

Table 12. Business analytical skills for the USA and UK

Managerial skills	Mathematical – informatics skills
Quality Management of Logistics and Supply Chain Processes Controlling in Logistics Data Management and Business Intelligence Operations Management Project and Process Management Supply Chain Strategic Management Project Risk and Cost Management Strategic Logistics Management Global Supply Chain Management Principles of Microeconomics Principles of Macroeconomics Change Management Risk Management Sustainable Supply Chain and Operations Management Six Sigma Techniques Process Analysis Enterprise Resource Planning – SAP	Business Process Modeling and Simulation Forecasting Techniques Artificial Intelligence and Machine Learning Mathematics & Statistics Business Analytics Foundations including R, SQL, and Power BI software Business process optimization Basics of Operations Research Advanced Decision Technology Process Engineering Data Mining Advanced Data Programming With R Data Base Management Data Programming Essentials With Python Fundamentals of Business Technology and Innovation Data Acquisition, Preparation and Visualization Process Optimization Performance Analytics Business Applications in Machine Learning Advanced Mathematics for Decision Making Optimization Methods and Tools Business Intelligence and Big Data Analytics Data Mining and Data Warehousing Big Data Analytics Problem Solving Techniques Data Analytics for Business Data Security

Source: Own study



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4. Analysis of educational programs from Spain, France and Benelux

4.1. General information

During this analysis, the curriculums of 5 countries were studied: Spain, Hungary, France, Netherlands and Belgium. We have reviewed 22 universities and faculties and 10 of them were selected for detailed review since they have study programmes related to business analysis in supply chain management area.

All reviewed countries have Bologna study process but with different structure: for bachelor studies 3, 3.5 or 4 years and for master studies 1 or 2 years. A short overview of the reviewed universities/faculties by country is given in the table below.

Table 13. Summary of reviewed HEI in Spain, Hungary, France, Netherlands and Belgium

	State	Total number of reviewed Universities	Total number of reviewed faculties	Extracted faculties with a project topic	System of higher education (bachelor + master in years)
1	Spain	5	5	1	4+1
3	Hungary	6	6	1	3,5+2
4	France	5	5	3	3+2
5	Netherlands	2	2	2	3+1
6	Belgium	4	4	3	1 (Master only); 3+1
	Sum	22	22	10	

Source: Own study

4.2. Curriculums and competencies

The most common pedagogical approach in analysed countries is traditional ex-cathedra teaching. The teaching materials consist mostly of PowerPoint slides and case-studies. The teaching is done in classrooms as classical lectures, workshops and seminars. However, on several students need to make a project related to the course topic or some lectures are organized in labs where some simulations were tested. There is a lack of modern approaches and tools like: interactive tables, online teaching courses, online interactive teaching materials which enable testing of different



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models/assumptions by students, solving real case studies in a BAS, playing serious business and BAS games, etc.

Table 14. Summary of reviewed HEI in Spain, Hungary, France, Netherlands and Belgium

State	University/Faculty	Level of study ⁷	Logistics knowledge ⁸	Business Analytics knowledge	General & supporting knowledge ⁹
Spain	Universitat Pompeu Fabra Barcelona (Spain), Faculty of Economics and Business https://www.bsm.upf.edu/en/master-science-management-supply-chain	M	22,5 %	22,5%	50,0%
Hungary	Széchenyi István University of Győr, Kautz Gyula Faculty of Business and Economics https://kgk.sze.hu/supply-chain-management-msc-information	M	50%	30%	20%
France	Rennes School of Business https://www.rennes-sb.com/programmes/postgraduate/msc/msc-data-business-analytics/	M	40%	60%	0%
	EMLV Business School in Paris https://www.emlv.fr/programmes/msc-supply-chain-management/	M	30%	30%	40%
	Montpellier Business School https://www.montpellier-bs.com/international/our-programmes/programmes-master-of-science/msc-management/msc-supply-chain-management/	M	25%	20%	55%
Netherlands	Erasmus University Rotterdam https://www.eur.nl/en/master-analytics-and-operations-research-logistics	M	30%	60%	10%
	University of Amsterdam https://ase.uva.nl/content/masters/data-science-and-business-analytics/data-science-and-business-analytics.html	M	10%	70%	20%

⁷ (B bachelor; M – master)

⁸ (technical and managerial)

⁹ (mathematics, management, economics, etc)



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Belgium	Antwerp Management School https://www.antwerpmanagementschool.be/en/program/master-global-supply-chain-management	M	60%	30%	10%
	United International Business Schools https://www.uibs.org/graduate_master_supply_chain_management.html	M	10%	12,5%	77,5%
	University of Applied Sciences and Arts https://www.kdg.be/en/global-supply-chain-management?utm_source=Study.eu&utm_medium=Listings&utm_campaign=ato&utm_term=&utm_content=profielpagina-engelstalige-bachelor-business-management	B	25%	10%	65%

Source: Own study

Table 15 presents a summary of the most important competencies related to business analytics in the area of supply chains identified at this stage of the analysis.

Table 15. Business analytical skills for Spain, Hungary, France, Netherlands and Belgium

Managerial skills	Mathematical – informatics skills
Data management Strategic analysis Econometrics Operations management Decision making ERP systems Data classification, processing and storage Information security Business process management Spreadsheet analysis Quality management	Machine learning Programming Statistics Python programming Regularisation Power BI Using Excel Discrete simulation Data mining Neural networks Decision trees Robotics Pattern recognition Speech recognition Genetic algorithms Algorithm design Stochastic models Supply chain forecasting

Source: Own study





5. Analysis of educational programs from Balkans

5.1. General information

In this analysis of the study curriculum's of the different HEI the region taken into consideration in the area of the Balkan Peninsula, and countries which partially spread over the Balkan Peninsula. Analysis include the following countries: Bulgaria, Greece, North Macedonia, Romania, Albania, Bosnia and Herzegovina, Croatia, Montenegro and Serbia. In total, we have review the 32 universities and 51 faculties and we selected 28 faculties with the topics issue. At some selected faculties, there are one or more study programs with the topic, as shown in Chapter 3 of this report.

Table 16. Summary of reviewed HEI in a Balkan Peninsula region

	State	Total number of reviewed Universities	Total number of reviewed faculties	Extracted faculties with a project topic	System of higher education (bachelor + master in years)
1	Bulgaria	7	8	1	4+1 (ili 1,5)
2	Greece	7	9	4	4+1 (ili 1,5)
3	North Macedonia	4	6	4	4+1 (ili 2)
4	Romania	3	6	5	4+2
5	Albania	2	2	1	3+2
6	Bosnia and Herzegovina	2	5	2	(4+1) (3+2)
7	Croatia	2	2	2	3+2
8	Montenegro	2	4	3	(3+1,5); (4+2)
9	Serbia	3	9	6	4+1
	Sum	32	51	28	

Source: Own study

5.2. Curriculums and competencies

The review of the curriculum's provided in different study programs revealed that there is a notable presence of classical traditional teaching techniques and lacking of new advanced teaching techniques and procedures. Accordingly, faculties use the classical teaching approach which can be described as: teaching in classrooms, student consultations, workshops, student exchange, internships, etc. As highlighted, there is lacking of modern approaches and tools like: interactive tables, online teaching courses, online interactive teaching materials which enable testing of different models/assumptions by students, solving real case studies in a BAS, playing serious business and BAS games, etc.



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Table 17. Summary of reviewed HEI in Spain, Hungary, France, Netherlands and Belgium

State	University/Faculty	Level of study ¹⁰	Logistics knowledge ¹¹	Business Analytics knowledge	General & supporting knowledge ¹²
Bulgaria	University of Economics – Varna Department of Industrial Business and Logistics https://ue-varna.bg/en/p/7861/about-us/faculties-and-departments/faculty-of-economics/department-of-industrial-business-and-logistics	B	12 (55%)	5 (22,5%)	5 (22,5%)
		M	6 (75%)	1 (12,5)	1 (12,5)
Greece	Athens University of Economics and Business School of business – Department of management science/technology https://www.dept.aueb.gr/en/dms	B1	1 (8%)	7 (58%)	4 (33%)
		B2	1 (6%)	12 (71%)	4 (23%)
	M	0	13 (87%)	2 (13%)	
	University of Thessaly School of Economics and Business Administration - Department Of Business Administration http://de.uth.gr/	B	1 (7%)	6 (43%)	7 (50%)
		M	1 (20%)	1 (20%)	3 (60%)
	University of Thessaly School of engineering - Department of mechanical engineering http://www.mie.uth.gr/n_page.asp?ID=57	M	3 (37,5%)	4 (50%)	1 (12,5%)
		University of Patras School of Economics and Business - Department of Management Science and Technology http://www.dept.upatras.gr/en/homepage/	B	1 (5%)	13 (69%)
North Macedonia	University St Cirilo i Metodije, Skopje Ekonomski fakultet https://eccf.ukim.edu.mk/		B1	1 (6%)	10 (59%)
		M	1 (17%)	4 (66%)	1 (17%)
		B2	1 (6%)	9 (56%)	6 (38%)
	University St Kliment Ohridski, Bitola	B	1 (10%)	4 (40%)	5 (50%)

¹⁰ (B bachelor; M – master)

¹¹ (technical and managerial)

¹² (mathematics, management, economics, etc)



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	Ekonomski fakultet, Prilep https://eccfp.uklo.edu.mk/				
	University St Kliment Ohridski, Bitola	B1	5 (50%)	1 (10%)	4 (40%)
	Faculty of Technical Sciences http://www.tfb.edu.mk/?l=eng	B2	1 (14%)	2(29%)	4 (57%)
	Univerzitet „Goce Delčev“ Štip	B	3 (43%)	1 (14%)	3 (43%)
	Fakultet za turizam i poslovnu logistiku https://ftbl.ugd.edu.mk/index.php/mk/	M	6 (67%)	1 (11%)	2 (22%)
Romania	Politehnica University of Bucharest https://upb.ro/en/	B	2 (18%)	5 (46%)	4 (36%)
	Faculty of Entrepreneurship, Business Engineering and Management				
	Politehnica University of Bucharest https://upb.ro/en/	B	2 (22%)	1 (11%)	6 (67%)
	Faculty of Industrial Engineering and Robotics				
	Politehnica University of Bucharest https://upb.ro/en/	M	1 (14%)	4 (57%)	2 (29%)
	Faculty of Automatic Control and Computer Science				
	Politehnica University of Bucharest https://upb.ro/en/	M	1 (17%)	3 (50%)	2 (33%)
	Faculty of Entrepreneurship, Business Engineering and Management				
	Polytechnic University of Timisoara	B	1 (10%)	3 (30%)	6 (60%)
	Faculty of Management in Production and Transport http://www.mpt.upt.ro/eng/index.html	M	7 (78%)	1 (11%)	1 (11%)
Albania	Epoka Universita	B1	2 (13%)	5 (33%)	8 (53%)
	Faculty of Economics and Administrative Sciences - Economics Department https://eco.epoka.edu.al/	B2	2 (18%)	2 (18%)	7 (64%)
		M	0	2 (33%)	4 (67%)



Bosnia	Univerzitet u Istočnom Sarajevu	B	12 (67%)	2 (11%)	4 (22%)
	Saobraćajni fakultet https://www.ues.rs.ba/la/saobracajni-fakultet-2/	M	13 (87%)	0	2 (13%)
	Univerzitet u Sarajevu	B	13 (59%)	3 (14%)	6 (27%)
	Fakultet za saobraćaj i komunikacije https://fsk.unsa.ba/prvi-ciklus	M	7 (54%)	4 (31%)	2 (15%)
Croatia	Univerzitet u Rijeci	B	10 (56%)	2 (11%)	6 (33%)
	Pomorski fakultet https://www.pfri.uniri.hr/web/hr/index.php	M	5 (50%)	2 (20%)	3 (30%)
	Univerzitet u Zagrebu	B	7 (54%)	1 (8%)	5 (38%)
	Fakultet prometnih znanosti https://www.fpz.unizg.hr/web/naslovna/novosti	M	8 (50%)	7 (44%)	1 (6%)
Montenegro	Univerzitet Crne Gore	B	2 (33%)	1 (17%)	3 (50%)
	Mašinski fakultet, Podgorica https://www.ucg.ac.me/mf				
	Univerzitet Crne Gore	B	4 (44,5%)	1 (11%)	4 (44,5%)
	Pomorski fakultet, Kotor https://www.ucg.ac.me/pfkotor	M	1 (17%)	3 (50%)	2 (33%)
	FSKL, Budva	B	14 (58%)	4 (17%)	6 (25%)
	Fakultet za saobraćaj, komunikacije i logistiku (FSKL) https://www.fskl-cg.me/	M	2 (40%)	1 (20%)	2 (40%)
Serbia	Univerzitet u Novom Sadu	B1	7 (54%)	1 (8%)	5 (38%)
	Fakultet tehničkih nauka (FTN) http://www.ftn.uns.ac.rs/691618389/fakultet-tehnickih-nauka	M1	4 (67%)	1 (16,5%)	1 (16,5%)
		B2	5 (36%)	2 (14%)	7 (50%)
		M2	3 (50%)	2 (33%)	1 (17%)
		B3	3 (20%)	6 (40%)	6 (40%)
		M3	1 (33%)	1 (33%)	1 (33%)
		B4	6 (46%)	2 (15%)	5 (39%)
		M4	3 (75%)	0	1 (25%)
		B5	3 (38%)	0	5 (62%)
		M5	1 (33%)	1 (33%)	1 (33%)
	Univerzitet u Beogradu	B	18 (53%)	9 (26%)	7 (21%)
	Saobraćajni fakultet https://www.sf.bg.ac.rs/index.php/sr-rs/	M	15 (83%)	3 (17%)	0
	Univerzitet u Beogradu	B	2 (15%)	5 (39%)	6 (46%)
	Fakultet organizacionih nauka http://www.fon.bg.ac.rs/	M1	1 (8%)	10 (77%)	2 (15%)
		M2	1 (7,5%)	11 (85%)	1 (7,5%)
Univerzitet u Beogradu	M	2 (50%)	1 (25%)	1 (25%)	



	Ekonomski fakultet http://www.ekof.bg.ac.rs/				
	Visoka škola za informacione i komunikacione tehnologije https://www.ict.edu.rs/	B	6 (46%)	4 (31%)	3 (23%)
	Strukovne studije Univerzitet u Nišu Mašinski fakultet http://www.masfak.ni.ac.rs/index.php/sr/	B	7 (47%)	4 (26,5%)	4 (26,5%)
		M	6 (46%)	6 (46%)	1 (8%)

Source: Own study

Table 18 presents a summary of the most important competencies related to business analytics in the area of supply chains identified at this stage of the analysis.

Table 18. Business analytical skills for Balkan Peninsula

Managerial skills	Mathematical – informatics skills
Quality Management of Logistics Activities	Statistics and Stochastics
Big Data Management Systems	Statistics for Business Analytics
Information Systems & Business Process Management	Operations Research
Management	Optimization Methods and Tools
Data Management and Business Intelligence	Forecasting Techniques
Controlling in Logistics	Time Series Analysis
Measuring the efficiency of business systems and processes	Process analysis and Petri nets
Operations Management	Data analysis and R software package
Business Decision Making	Discovering regularities in data
Business Process Management	Combinatorial optimization and metaheuristics
Business information systems	Multivariate analysis
Databases for business	Quantitative Methods for Business Decision Making
Strategic Analyses of Business Econometrics	Advanced Mathematics for Decision Making
Ekonometrija finansijskih tržišta	Business Intelligence and Big Data Analytics;
Cost-Benefit Analysis for Business	Analysis&Modeling of Business Processes and Systems
Intelligentni sistemi za podršku odlučivanju	Business process optimization
	Enterprise Resource Planning Systems (ERP)
	Stochastic Modeling& Simulation;
	Simulation of Logistics and Supply Chains
	Business Process Modelling and Simulation
	Software tools in logistics
	Business Data Analytics
	Business Analytics Applications



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	<p>Business Analytics and Personalisation Technologies</p> <p>Processing of Business Data</p> <p>Big Data Systems</p> <p>Large Scale Optimization</p> <p>Data Mining and Data Warehousing</p> <p>Designing the databases</p> <p>Data Mining and Machine Learning</p> <p>Artificial Intelligence and Machine Learning</p> <p>Artificial Intelligence and Big Data in Business</p> <p>Applied Machine Learning;</p> <p>Game Theory</p> <p>IoT and SCADA Technologies</p> <p>Systems for automatic identification</p> <p>Artificial intelligence in engineering</p> <p>Integrated enterprise management (SAP, ERP)</p> <p>Software tools for data management</p> <p>GIS in logistics</p>
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Source: Own study



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6. Analysis of educational programs from Scandinavia and Slovenia

6.1. General information

Due to the different countries and region, we will represent each of the educational systems separately, with an emphasis on the tertiary level as this is the focus of BAS4SC project.

a) Slovenia

Slovenia is a small European country that stretches over an area of 20 273 km² between the Alps, the Adriatic Sea and the Pannonia Plain. Slovenia shares land borders with Austria at 318 km, Italy at 280 km, Hungary at 102 km, and Croatia at 670 km, total border length of 1 370 km. The coastline extends over 46.6 km. The capital of Slovenia is Ljubljana.

The primary goal of the education system in Slovenia is to provide optimal development of the individual, irrespective of gender, social and cultural background, religion, racial, ethnic or national origin, and regardless of their physical and mental constitution or physical and mental disability. Right to free education is enshrined in Constitution of the Republic of Slovenia. Basic education is compulsory and is publicly funded. The state is obliged to create opportunities for citizens to obtain proper education. Universities and colleges are autonomous.

Slovenia is actively involved in the Bologna process and as a member of the European Union committed to the objectives of the Lisbon Strategy. It aims to establish a high quality, diverse and accessible, as well as internationally comparable tertiary education system. Among the most important objectives of tertiary education are quality, employability and mobility in Europe and the world, fair access, as well as diversity of institutions and study programmes. The tertiary education in Slovenia consists of short-cycle higher vocational education and higher education. Both subsystems of tertiary education are interrelated in that they are linked by a system of quality assurance, students' progression from lower to higher level education, and also partly by institutional and programme compatibility.



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Higher education is organized at public and private universities and independent higher education institutions. In the 2018/2019 academic year, over 65 500 students pursued studies at faculties, art academies and higher education professional institutions. The number of higher education institutions has increased markedly in the last decade. In 2018/2019, there were three public and three private universities, one independent public higher education institution and 48 private higher education institutions in Slovenia.

The main tasks of higher education institutions – scientific or artistic work, and education - are determined by law. Strategic objectives for individual five- to ten year periods are determined by the national higher education programme adopted by the National Assembly of the Republic of Slovenia. Higher education is organized in three study cycles. The first-cycle features professional and academic undergraduate study programmes; the second-cycle features postgraduate master's study programmes (master's or integrated master's), and the third-cycle postgraduate doctoral study programmes. Study programmes are carried out as full-time or part-time studies or in the form of distance learning.

b) Norway

Norway is a large country, with relatively few inhabitants. 100 years ago, Norway was among the poorest countries in Europe. Today, Norway ranks among the richest countries in the world. The Norwegian economic and welfare model has managed to achieve a relatively compressed wage system, low unemployment rates, high labour market participation – particularly for women – and still impressive economic growth. The Norwegian welfare system is well-developed, based on universal entitlements. The municipalities are responsible for basic welfare services, including primary and lower secondary education, and have substantial autonomy in allocation of resources between sectors and in provision of services. The counties are responsible for upper secondary education and training and post secondary vocational education, whereas the national Government is responsible for other higher education.



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Higher education is in Norway defined as education and training provided at universities, specialised university institutions, university colleges, university colleges of arts, other public university colleges not under the auspices of the Ministry of Education and Research, and private higher education institutions.

Since the Quality Reform of 2002, higher education institutions offer 3-year bachelor's degrees, 2-year master's degrees and 3-year Ph.D. degrees. A few study programmes are shorter than 3 years, there are some integrated five to five and half year master degrees and some professional study programmes that last 6 years. In addition, there are some master programmes of less than two years duration.

c) Finland

Education is one of the cornerstones of the Finnish welfare society. We pride ourselves on an educational system that offers equal educational opportunities for all. Education all the way from pre-primary to higher education is free of charge in Finland. In addition, Finnish teachers are highly educated and strongly committed to their work. The mission of universities is to conduct scientific research and provide education based on it. Universities of applied sciences offer more practical education that aims to respond to the needs of the labour market. Universities, which provide higher scientific and artistic education, award Bachelor's and Master's degrees as well as postgraduate degrees, i.e. licentiate and doctoral degrees. Universities of applied sciences award Bachelor's degrees and Master's degrees. The normative duration of studies for a Bachelor's degree at a university is three years and for a Master's degree an additional two years. The completion of a degree at a university of applied sciences usually takes between 3.5 and 4.5 years. The requirement for Master's studies at a university of applied sciences is a Bachelors' degree or another appropriate degree and at least two years of work experience after the completion of the previous degree.

d) Denmark

Quality assurance, lifelong learning and active participation are important features of the Danish education system. Danish education aims to ensure that all people acquire knowledge and competencies that qualify them to take an active part in society



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and contribute to its further development. Education is open to all and generally free of charge.

Public higher education institutions in Denmark are regulated by national legislation concerning degree structures, teacher qualifications and examinations. Accreditation in higher education is undergoing transition from programme-based accreditation to institutional accreditation. Programmes and institutions are accredited by national, independent accreditation agencies and the Accreditation Council.

The qualification levels form the basis for the Danish National Qualifications Framework for Higher Education, which is certified in accordance with the overarching Bologna Framework according to the principles adopted by the European Ministers of Higher Education. Danish higher education qualifications at levels 5-8 of the Danish Qualifications Framework for Lifelong Learning (NQF) correspond with levels 5-8 of the European Qualifications Framework (EQF).

e)Sweden

Almost half the Swedish population is involved in some form of organised education. All education, from preschool class to higher education, is free of charge. Sweden has among the highest public spending on education relative to GDP in the EU.

Higher education and research in Sweden take place at 48 institutions of four different categories: universities (universitet), university colleges (högskolor), university colleges of fine, applied and performing arts (konstnärliga högskolor), and other independent higher education providers (enskilda utbildningsanordnare).

Mainly as a result of the Bologna process, legislation for a three-cycle structure of higher education has been adopted and is applied since 2007. The degree system is now structured to fit the three-cycle system.

The Ministry of Education and Research (Utbildningsdepartementet) is responsible for the system of higher education. Higher education is financed through state grants to the individual institutions based on the number of students and their



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achievements with varying amounts of remuneration for the various educational areas. Independent institutions that receive governmental grants cannot charge tuition fees. There are some independent institutions that do not receive governmental grants; hence they are free to charge tuition fees. These institutions are classified as private.

The Swedish Higher Education Authority (Universitetskanslersämbetet) manages quality control for higher education and degree authorisation of state universities. It is responsible for the legal oversight and the efficiency review, analysis and statistical monitoring of higher education. The Swedish Council of Higher Education (Universitets- och högskolerådet) administers admission to study programmes on behalf of the higher education institutions.

Table 19. Summary of reviewed HEI in Scandinavia and Slovenia

	State	Total number of reviewed Universities	Total number of reviewed faculties	Extracted faculties with a project topic	System of higher education (bachelor + master in years)
1	Slovenia	2	2	2	3 + 2
2	Norway	2	2	2	3 + 2
3	Finland	2	2	2	3 + 2
4	Sweden	3	3	3	3 + 2
5	Denmark	2	2	2	3 + 2
	Sum	11	11	11	

Source: Own study

6.2. Curriculums and competencies

As can be observed, most courses follow the pedagogical approach of lecturing, followed by project or problem-based learning, supply chain/life cycle analysis and jigsaw/interlinked teams. Excluding lecturing, which represents the standard approach of introducing subject materials and concepts to students, we are more interested in other systems. We can see that the courses related to logistics are project- or problem-based oriented, considering that logistics face everyday challenges and exciting



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results. Thus many universities are trying to prepare their students to work in project-based teams, which can also be either interlinked or interdisciplinary, as logistics, after all, is a multidisciplinary sector. Additionally, the supply chain and LCA are highly incorporated into studies, making sense as logistics is a part of either a global or local supply chain, providing services that make the supply chain work daily. Thus universities, along with logistics and supply chains, incorporate basic and advanced knowledge about the interrelationship between both concepts. Furthermore, there is a definitive indication that universities want to establish connections between the education sector and the community, promoting collaboration in the direction of environmental and ecological improvements. This aligns with the sustainable approach, which is lately being implemented in supply chains and logistics on a larger scale. Lastly, although presented more on the sideline, we can see that there is also a push on case studies and participatory action research, which can be translated into universities encouraging students to work in real case scenarios. This is an absolute boon, as only attaining theoretical knowledge can be a setback when students face real-case situations.

Table 20. Summary of reviewed HEI in Scandinavia and Slovenia

State	University/Faculty	Level of study ¹³	Logistics knowledge ¹⁴	Business Analytics knowledge	General & supporting knowledge ¹⁵
Slovenia	University of Maribor/Faculty of Logistics (https://fl.um.si/en/study/study-programmes/)	B	10 (45 %)	6 (27,5%)	6 (27,5%)
		M	11 (50%)	5 (22,7%)	6 (27,3%)
Slovenia	University of Ljubljana/ School of Economics and Business (http://www.ef.uni-lj.si/content/static_english/izobrazevanje/study_programs_home.asp)	B	1 (10 %)	4 (20 %)	20 (80 %)
		M	6 (50 %)	1 (8%)	5 (42%)

¹³ (B bachelor; M – master)

¹⁴ (technical and managerial)

¹⁵ (mathematics, management, economics, etc)





Norway	NTNU (https://www.ntnu.edu/studies/allstudies?city=&studyLevel=&field=&query=&open=true)	B	0	0	0
		M	5 (26%)	7 (37%)	7 (37%)
Norway	Molde University College (https://www.himolde.no/english/studies/programmes/)	B	0	0	0
		M	18 (53%)	8 (23,5%)	8 (23, 5%)
Sweden	KTH (https://www.kth.se/en/studies)	B	0	0	0
		M	9 (60 %)	1 (7 %)	5 (33 %)
Sweden	University of Stockholm (https://www.su.se/cmlink/stockholm-university)	B	1 (11,5 %)	1 (11,5 %)	7 (77%)
		M	0	0	0
Sweden	Chalmers University (https://www.chalmers.se/en/Pages/default.aspx)	B	0	0	0
		M	4 (30 %)	2 (16 %)	7 (54 %)
Denmark	Technical University of Denmark (https://www.dtu.dk/English)	B	0	0	0
		M	7 (20 %)	15 (45 %)	12 (35 %)
Denmark	University of Southern Denmark (https://www.sdu.dk/en)	B	0	0	0
		M	3 (37,5 %)	2 (25 %)	3 (37,5 %)
Finland	Lappeenranta-Lahti University of Technology LUT (https://www.lut.fi/en)	B	0	0	0
		M	10 (30 %)	6 (25 %)	14 (47 %)
Finland	University of Vaasa (https://www.uvasa.fi/en)	B	2 (22 %)	0	7 (78 %)
		M	3 (12,5 %)	12 (50 %)	9 (37,5%)

Source: Own study

Table 21 presents a summary of the most important competencies related to business analytics in the area of supply chains identified at this stage of the analysis.

Table 21. Business analytical skills for Scandinavia and Slovenia

Managerial skills	Mathematical – informatics skills
Introduction to Information Security Management Cost Management in SCM Performance Measurement and Management Security Management Metrics Strategic Management Supply Chain Management	Digital economics Supply Chain Analytics Dynamic Simulation of closed-loop systems Modelling and Simulation of Dynamic Systems Applied statistics Enterprise Resource Planning Systems Applied data analytics Exact Optimization methods in logistics



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<p>Quality and Performance Oriented Management</p> <p>Purchasing and Logistics Management</p> <p>Supply Chain Management I</p> <p>Purchasing and Supply theory</p> <p>Applied Supply Chain Management</p> <p>Models for production management</p> <p>Inventory Management</p> <p>Measuring and Managing Performance in Shipping, Logistics and Supply Chains</p> <p>Supply Chain Management</p> <p>Logistics & Supply Chain Management</p> <p>Purchasing & Supply Chain Management</p> <p>Supply Chain Risk Management</p> <p>Management control</p> <p>Sales and service management</p> <p>Retail Management control</p> <p>Purchasing and supply management</p> <p>Lean Management</p> <p>Production Flow management</p> <p>Quality Management</p> <p>Management of Physical distribution</p> <p>Project Management</p> <p>Service Management</p> <p>Sustainable Operation and Supply Chain Management</p> <p>Risk Management</p> <p>Environmental Management, innovation and Ethics</p> <p>Advanced Engineering Project, Program and Portfolio Management</p> <p>Operations management: Systems and methods</p> <p>Advanced Quality Management</p> <p>The core of Innovation Management</p> <p>Basics of Logistics and Supply Chain Management</p> <p>Trends in Innovation and Technology Management</p> <p>Risk and Value Management in Supply Chains</p> <p>Strategic Supply Management</p> <p>Supply Chain Design and Management</p> <p>Financial Supply Management</p> <p>External Resource Management</p> <p>Management Consulting Case workshop</p> <p>Quality and Reliability Management</p> <p>Production operations management methods</p> <p>Project management</p> <p>Sustainable Supply Chain Management and Circular Economy</p> <p>Blockchain in Supply Chain and Logistics Management</p> <p>Innovative Product Development and Product Lifecycle Management</p> <p>Sales Management and negotiation skills</p>	<p>Discrete event simulation</p> <p>Vehicle routing</p> <p>Heuristics in analytics</p> <p>Last Mile Delivery: data analytics and models</p> <p>Applied dynamic and stochastic programming for logistics</p> <p>Game theory applied in logistics</p> <p>Building Informatics and Logistics</p> <p>Supply Chain Analytics</p> <p>Stochastic Simulation</p> <p>Multivariate Statistics</p> <p>Advanced Data analysis and Statistical Modelling</p> <p>Integer Programming</p> <p>Network Optimization</p> <p>Transport Optimization</p> <p>Large Scale optimization using decomposition</p> <p>Optimization using metaheuristics</p> <p>Model-based machine learning</p> <p>Agent-based modelling and simulation</p> <p>Advances Business Analytics</p> <p>Operations analysis</p> <p>Supply chain simulation</p> <p>Data science and machine learning</p> <p>Quantitative Models and Methods of Logistics</p> <p>Complex Systems</p> <p>System modelling</p> <p>Supply Chain Analytics Projects</p> <p>Statistical data processing SPSS</p> <p>Probability and statistics</p> <p>Statistical Data processing SAS EG</p> <p>Probability and stochastic processes</p> <p>Applied multivariate statistics</p> <p>Lean Six Sigma Statistical control</p> <p>Measuring the efficiency and performance of the supply chain</p> <p>Information support in logistics systems and processes</p> <p>Quantitative methods and models in logistics systems</p> <p>Mathematical models and methods in business logistic systems</p> <p>Theory of optimization and modelling design in smart logistic systems</p> <p>Modelling of intralogistics systems</p> <p>Computer science in logistics</p> <p>Informatics and information security in organizations</p> <p>Quantitative modelling in logistics</p> <p>Statistical modelling in logistics</p> <p>Advanced modelling in logistics</p> <p>Introductory statistics</p>
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<p>Fundamental of management Introduction to production management Analytics in project management Core management skills and business principles Human resource management in logistics Intralogistics and project management Operations Management Human Resource Management Strategic Management 1 Electronic Business Business Logistics Management international business environment Strategic Management 2 Purchasing management International business logistics Business Skills Development</p>	
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Source: Own study





Summary

A review of Business Analytics (BA) and Business Analytics for Supply Chain (BAS) curricula across regions reveals significant differences in educational approaches. British and American universities rank high in international rankings, offering a wide range of courses tailored to student needs. They have the resources to implement modern technologies and teaching methods, but an analysis of the programs shows that theoretical content dominates in both countries. Practical application of analytical tools is limited, and many courses leave students to independently translate theory into real-world cases, which is difficult without appropriate support.

American programs place a greater emphasis on practical skills than British programs, which focus on logistics and management. Both countries offer a predominance of master's degrees over bachelor's degrees, but there are no courses in programming, modeling, simulation, or data visualization. Traditional teaching methods are still used, such as solving optimization problems by manually creating simplex tables, without the use of modern tools. The greatest gaps are found in subjects related to modern technologies and practical BA skills, such as quantitative and qualitative analysis (metaheuristics, optimization, fuzzy logic, AI, machine learning), visualization techniques (Power BI, Tableau), ERP systems (SAP, MS Dynamics), process modeling and simulations (ARIS, Arena), programming (Python, R, SQL, TensorFlow), and analytical communication tools (Slack, GitHub). In many cases, courses are limited to simple analyses in Excel, without introducing advanced methods.

Universities in the Netherlands stand out in this context, where over 60% of the curriculum consists of BA subjects, including machine learning, mathematical programming, and business simulations. Similarly, in Greece and, to some extent, in Serbia, modern analytical content is more easily implemented thanks to a strong mathematical foundation. In Scandinavian countries (Denmark, Finland, Norway, and Sweden), interdisciplinarity and a greater share of practical classes, including case studies and team projects, are noticeable. Modern tools such as GIS systems for route



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planning and statistical analysis software are promoted, preparing students for real-world market challenges. Despite positive examples, most programs still lack forward-looking subjects such as artificial intelligence, neural networks, and advanced optimization methods. Closer collaboration between universities and industry is recommended to increase the share of practical classes and enable students to gain experience in real-world business environments. Incorporating modern tools and methods into curricula is crucial to ensure that graduates are prepared for work in a dynamically changing economic environment.

A full analysis of the educational programs can be found in the attachment: Attachment 1_BAS4SC_WP2_Curriculum_benchmark

Final list of competencies, which will be used in the research conducted in tasks A2.2 and A2.3:

- Forecasting Techniques
- Business Data Analytics
- Statistics for Business Analytics
- Sampling and Experimental Design
- Spatial Statistics
- Data Ethics and Data Security
- Stochastic Simulation
- Optimization in Supply Chain Management
- Optimization models and heuristic methods for managing production systems
- Vehicle routing
- Heuristics in analytics
- Last Mile Delivery: data analytics and models
- Game theory applied in logistics
- Lean Six Sigma Statistical control
- Data Visualisation Methods
- Creation of Reports and Dashboards
- Spreadsheet analysis
- Big Data Research Methods
- Big Data Systems





- Software tools in logistics
- Microsoft Excel
- Data analysis and R software packages
- Data mining
- Social Network Analysis
- Python for Data Science
- Business Analytics Foundations including R, SQL, and Power BI software
- Statistical data processing SPSS
- Statistical Data processing SAS EG
- Data Mining and Data Warehousing
- Designing the databases
- SQL
- Software tools for data management
- Enterprise Resource Planning Systems (ERP)
- Integrated enterprise management (SAP, ERP)
- IoT and SCADA Technologies
- Data protection
- Information security
- Systems for automatic identification (RFID, barcodes)
- Blockchain Technologies
- General programming
- Artificial Intelligence and Machine Learning
- Software tools in logistics
- GIS in logistics
- Discrete event simulation
- Stochastic Modeling
- Business Process Modelling
- Simulation of Logistics and Supply Chains
- Agent-based modelling and simulation
- Power BI
- Tableau
- Principles of Microeconomics
- Principles of Macroeconomics
- Data Management and Business Intelligence



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- Data Security Management
- Knowledge Management
- Controlling in Supply Chain Management
- Supply Chain and Sourcing
- Supply Chain Risk Management
- Mathematical models for Supply Chain Management
- Inventory Management
- Outsourcing (Make of Buy)
- e-logistics
- Information Systems & Business Process Management
- Quality management
- Sales and service management
- Lean Management
- Six Sigma Techniques
- Strategic Analyses
- Cost-Benefit Analysis for Business
- Econometrics
- Digital economics
- Inference fuzzy
- Neural networks
- Decision trees
- Pattern recognition
- Genetic algorithms
- Latent Dirichlet Allocation algorithm
- Latent Semantic Analysis
- Discovering regularities in data
- Understanding and interpreting the data
- Advanced Mathematics for Decision Making
- Game Theory
- Operations Research
- Optimization Methods and Tools
- Combinatorial optimization and metaheuristics
- Large Scale Optimization
- Integer Programming





- Network Optimization
- Transport Optimization
- Optimization using metaheuristics
- Algorithm design
- Introductory statistics
- Statistics for Business Analytics
- Correlation analysis
- Multivariate analysis
- Hypothesis testing
- Linear Regression with Single and Multiple Regressors
- Dynamic Simulation of closed-loop systems
- Modelling and Simulation of Dynamic Systems
- Complex Systems
- Process analysis and Petri nets

Attachments

- Attachment 1_BAS4SC_WP2_Curriculum_benchmark



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