



**BAS4SC –
BUSINESS
ANALYTICS
SKILLS FOR THE
FUTURE-PROOF
SUPPLY CHAINS**

**COMPETENCE
GAP IN STUDY
PROGRAMS
ACCORDING
TO
RESULTS
CONDUCTED
RESEARCH**

BAS4SC Project Team



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1. Introduction

The aim of the report summarizing the implementation of task A2.4 and the entire WP2 is to highlight the most important analytical competences and assign them to three courses on the following topics:

- C1: Advanced using of spreadsheet to analyse logistics data;
- C2: Business Intelligence;
- C3: Statistical method to analysing a logistics data.

The most important competencies are identified based on the competency gap, which is defined as a set of competencies important from the perspective of business managers, academic teachers, and, in the opinion of students (including graduates), not being implemented within the educational programs operating within the consortium.

Tables 1-4 present the set of analyzed competencies. The set of competencies was developed based on the results of the review of educational programs conducted as part of Task A2.1. To better organize the competencies, they were divided into four areas:

- Applied math & statistics;
- IT skills;
- Managerial skills;
- Mathematical skills (theoretical aspects).

Within each area, sets of competencies were also identified, each with its own specific competencies assigned. This structure allowed for better organization of research tools and enabled the aggregation of results for subsequent further exploration (not directly implemented within the project—going beyond the project's scope but interesting from a research perspective).

Tables 1-4 present the analysed competences divided into four areas.





Table 1. Skills in area Applied math & statistics

Skills area	Skills	Competence (Indicative content)	
Applied math & stat	AM&S Data analysis and statistics	Forecasting Techniques	
		Business Data Analytics	
		Statistics for Business Analytics	
		Sampling and Experimental Design	
		Spatial Statistics	
		Data Ethics and Data Security	
		Stochastic Simulation	
	AM&S Optimization in logistics	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	
	AM&S Visualization and reporting	Lean Six Sigma Statistical control	
		Data Visualisation Methods	
			Creation of Reports and Dashboards

Source: Own study



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Table 2. Skills in area IT

Skills area	Skills	Competence (Indicative content)
IT skills	IT BI tools	Spreadsheet analysis
		Big Data Research Methods
		Big Data Systems
		Software tools in logistics
		Microsoft Excel
	IT Data analytics tools	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
	IT Database	Data Mining and Data Warehousing
		Designing the databases
		SQL
		Software tools for data management
	IT Management systems	Enterprise Resource Planning Systems (ERP)
		Integrated enterprise management (SAP, ERP)
	IT Other IT tools	IoT and SCADA Technologies
		Data protection
		Information security
		Systems for automatic identification (RFID, barcodes)
		Blockchain Technologies
IT Programming	General programming	



		Artificial Intelligence and Machine Learning
		Software tools in logistics
		GIS in logistics
	IT Simulations	Discrete event simulation
		Stochastic Modeling
		Business Process Modelling
		Simulation of Logistics and Supply Chains
		Agent-based modelling and simulation
	IT Visualisation	Power BI
		Tableau

Source: Own study

Table 3. Skills in area managerial skills

Skills area	Skills	Competence (Indicative content)
Managerial skills	MANS Basics of economics	Principles of Microeconomics
		Principles of Macroeconomics
	MANS Data and knowledge management	Data Management and Business Intelligence
		Data Security Management
		Knowledge Management
	MANS Logistics and supply chain 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
	MANS Quality and process management	Information Systems & Business Process Management





		Quality management
		Sales and service management
		Lean Management
		Six Sigma Techniques
	MANS Strategic and economic analyses	Strategic Analyses
		Cost-Benefit Analysis for Business
		Econometrics
		Digital economics

Source: Own study

Table 4. Skills in area mathematical skills

Skills area	Skills	Competence (Indicative content)
Mathematical skills (theoretical aspects)	MATS AI & ML	Inference fuzzy
		Neural networks
		Decision trees
		Pattern recognition
		Genetic algorithms
	MATS Data analysis and knowledge mining	Latent Dirichlet Allocation algorithm
		Latent Semantic Analysis
		Discovering regularities in data
		Understanding and interpreting the data
	MATS Decision and game theory	Advanced Mathematics for Decision Making
		Game Theory
	MATS Optimization and Operational Research	Operations Research
		Optimization Methods and Tools
		Combinatorial optimization and metaheuristics
		Large Scale Optimization





		Integer Programming
		Network Optimization
		Transport Optimization
		Optimization using metaheuristics
		Algorithm design
	MATS Statistics and quantitative analysis	Introductory statistics
		Statistics for Business Analytics
		Correlation analysis
		Multivariate analysis
		Hypothesis testing
	MATS System modeling and simulation	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

Source: Own study

The competency structure presented in Table 1-4 was used in the research conducted within Tasks A2.2 and A2.3. Analysis of the research results allowed us to identify competency gaps and highlight those that should inform the development of courses. The analysis methodology is presented in Chapter 2 of this report.



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2. Methodology

The methodology for identifying the most important analytical competencies was divided into two parts. The most important competencies are those taught within analytical programs at leading universities in Europe and the US, perceived as essential from the perspective of managers of logistics and manufacturing companies (including entrepreneurs), and are not simultaneously (or are insufficiently) taught at the universities of the Partners implementing the BAS4SC project. This relationship was defined as a competency gap.

In the first part of the methodology, a team of experts from the Partner universities assigned analytical competencies to three groups aligned with the topics of the courses to be developed in WP3:

- C1: Advanced using of spreadsheet to analyse logistics data
- C2: Business Intelligence
- C3: Statistical method to analysing a logistics data.

In the second part of the methodology, competencies were analyzed in two dimensions:

- Frequency of appearance in the curricula of leading universities in Europe and the USA;
- Results of surveys conducted among students (including graduates) and academic teachers – A2.2, and managers of logistics and manufacturing companies (including entrepreneurs) – A2.3

Identifying the competency gap is one of the most important steps in the methodology. The research gap, as defined, was identified based on survey results (A2.2 and A2.3). A competency was included in the competency gap if it met the following criteria:

- Median importance from the perspective of managers of logistics and manufacturing companies (including entrepreneurs) – (study result A2.3) – minimum 4;





- The total percentage of academic teachers' responses to "Agree in this: theory and application in practice" and "but for real application in practice, students had to do additional self-education," indicating their positive opinion on including this competency in the curriculum, was higher than the total percentage of responses expressing no such approval;
- The total percentage of student responses to "Very important" and "Important" was higher than the total percentage of responses from the remaining categories.

Competencies that meet the above criteria were defined as a competency gap.

Based on the competency ranking and the fulfillment of the competency gap requirements (identified based on research results), competencies were selected that will form the basis of the course content being developed – content development in WP3.

The methodology concludes with a review of the relevance of the selected competencies and a comparison with competencies that will not be implemented using the teaching materials being developed in WP3.

Fig 1. demonstrates the methodology for classifying the BAS skills to the three courses:

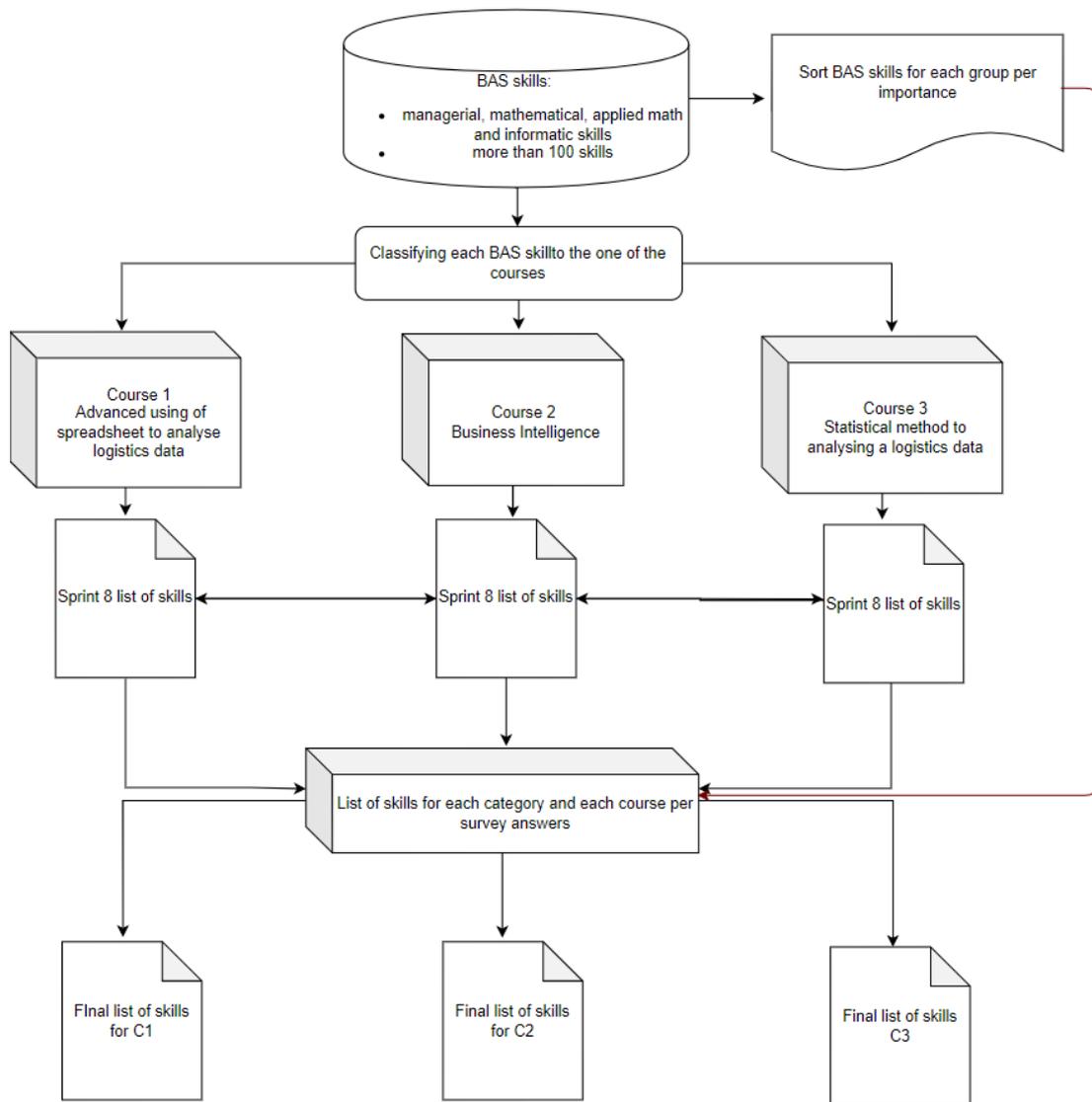


Fig 1. Methodology for classifying the BAS skills

Source: Own study



3. Analysis of results

Table 5 presents a ranking of competencies based on the results of a review of the study programs (related to business analytics) of universities in Europe and the USA. The frequency of occurrence of a given competency in the ranking was used to create a Pareto analysis (ABC, 80/20).

Table 5. Ranking for each BAS skills

No.	BAS skills	Category
77	Informatic skills (business intelligence tools) [Microsoft Excel]	A
96	Informatic skills (Management systems) [Integrated enterprise management (SAP, ERP)]	A
95	Informatic skills (Management systems) [Enterprise Resource Planning Systems (ERP)]	A
2	Managerial skills [Data Management and Business Intelligence]	A
76	Informatic skills (business intelligence tools) [Software tools in logistics]	A
73	Informatic skills (business intelligence tools) [Spreadsheet analysis]	A
5	Managerial skills [Cost-Benefit Analysis for Business]	A
75	Informatic skills (business intelligence tools) [Big Data Systems]	A
54	Applied math & stat [Business Data Analytics]	A
52	Applied math & stat [Optimization in Supply Chain Management]	A
4	Managerial skills [Strategic Analyses]	A
10	Managerial skills [Supply Chain and Sourcing]	A
100	Informatic skills (Other IT tools) [Systems for automatic identification (RFID, barcodes)]	A
11	Managerial skills [Supply Chain Risk Management]	A
99	Informatic skills (Other IT tools) [Information security]	A
74	Informatic skills (business intelligence tools) [Big Data Research Methods]	A
18	Managerial skills [e-logistics]	A
13	Managerial skills [Inventory Management]	A
87	Informatic skills (Different software tools) [Software tools in logistics]	A
1	Managerial skills [Information Systems & Business Process Management]	A
71	Informatic skills (simulations) [Simulation of Logistics and Supply Chains]	A
98	Informatic skills (Other IT tools) [Data protection]	A
36	Mathematical skills (theoretical aspects) [Transport Optimization]	A
14	Managerial skills [Sales and service management]	A
53	Applied math & stat [Forecasting Techniques]	A
51	Mathematical skills (theoretical aspects) [Understanding and interpreting the data]	A
55	Applied math & stat [Data Visualisation Methods]	A



3	Managerial skills [Controlling in Supply Chain Management]	A
23	Mathematical skills (theoretical aspects) [Optimization Methods and Tools]	A
92	Informatic skills (Databases) [Software tools for data management]	A
86	Informatic skills (programming) [Artificial Intelligence and Machine Learning]	A
89	Informatic skills (Databases) [Data Mining and Data Warehousing]	B
61	Applied math & stat [Vehicle routing]	B
8	Managerial skills [Data Security Management]	B
67	Applied math & stat [Creation of Reports and Dashboards]	B
56	Applied math & stat [Statistics for Business Analytics]	B
88	Informatic skills (Different software tools) [GIS in logistics]	B
85	Informatic skills (programming) [General programming]	B
90	Informatic skills (Databases) [Designing the databases]	B
82	Informatic skills (data analytics) [Business Analytics Foundations including R, SQL, and Power BI software]	B
9	Managerial skills [Knowledge Management]	B
16	Managerial skills [Outsourcing (Make of Buy)]	B
101	Informatic skills (Other IT tools) [Blockchain Technologies]	B
91	Informatic skills (Databases) [SQL]	B
70	Informatic skills (simulations) [Business Process Modelling]	B
35	Mathematical skills (theoretical aspects) [Network Optimization]	B
45	Mathematical skills (theoretical aspects) [Statistics for Business Analytics]	B
15	Managerial skills [Lean Management]	B
60	Applied math & stat [Data Ethics and Data Security]	B
7	Managerial skills [Quality management]	B
22	Mathematical skills (theoretical aspects) [Operations Research]	B
27	Mathematical skills (theoretical aspects) [Large Scale Optimization]	B
47	Mathematical skills (theoretical aspects) [Discovering regularities in data]	B
12	Managerial skills [Mathematical models for Supply Chain Management]	B
79	Informatic skills (data analytics) [Data mining]	B
93	Informatic skills (visualisation) [Power BI]	B
81	Informatic skills (data analytics) [Python for Data Science]	B
63	Applied math & stat [Last Mile Delivery: data analytics and models]	B
97	Informatic skills (Other IT tools) [IoT and SCADA Technologies]	B
17	Managerial skills [Digital economics]	B
80	Informatic skills (data analytics) [Social Network Analysis]	B
57	Applied math & stat [Optimization models and heuristic methods for managing production systems]	B
26	Mathematical skills (theoretical aspects) [Advanced Mathematics for Decision Making]	B
66	Applied math & stat [Lean Six Sigma Statistical control]	B
46	Mathematical skills (theoretical aspects) [Correlation analysis]	B





21	Managerial skills [Six Sigma Techniques]	B
78	Informatic skills (data analytics) [Data analysis and R software packages]	C
58	Applied math & stat [Sampling and Experimental Design]	C
59	Applied math & stat [Spatial Statistics]	C
40	Mathematical skills (theoretical aspects) [Decision trees]	C
64	Applied math & stat [Game theory applied in logistics]	C
6	Managerial skills [Econometrics]	C
20	Managerial skills [Principles of Macroeconomics]	C
43	Mathematical skills (theoretical aspects) [Algorithm design]	C
19	Managerial skills [Principles of Microeconomics]	C
83	Informatic skills (data analytics) [Statistical data processing SPSS]	C
48	Mathematical skills (theoretical aspects) [Multivariate analysis]	C
41	Mathematical skills (theoretical aspects) [Pattern recognition]	C
72	Informatic skills (simulations) [Agent-based modelling and simulation]	C
44	Mathematical skills (theoretical aspects) [Introductory statistics]	C
39	Mathematical skills (theoretical aspects) [Neural networks]	C
49	Mathematical skills (theoretical aspects) [Hypothesis testing]	C
84	Informatic skills (data analytics) [Statistical Data processing SAS EG]	C
37	Mathematical skills (theoretical aspects) [Optimization using metaheuristics]	C
38	Mathematical skills (theoretical aspects) [Complex Systems]	C
33	Mathematical skills (theoretical aspects) [Modelling and Simulation of Dynamic Systems]	C
34	Mathematical skills (theoretical aspects) [Integer Programming]	C
62	Applied math & stat [Heuristics in analytics]	C
65	Applied math & stat [Stochastic Simulation]	C
42	Mathematical skills (theoretical aspects) [Genetic algorithms]	C
68	Informatic skills (simulations) [Discrete event simulation]	C
94	Informatic skills (visualisation) [Tableau]	C
69	Informatic skills (simulations) [Stochastic Modeling]	C
25	Mathematical skills (theoretical aspects) [Combinatorial optimization and metaheuristics]	C
28	Mathematical skills (theoretical aspects) [Inference fuzzy]	C
50	Mathematical skills (theoretical aspects) [Linear Regression with Single and Multiple Regressors]	C
24	Mathematical skills (theoretical aspects) [Process analysis and Petri nets]	C
32	Mathematical skills (theoretical aspects) [Dynamic Simulation of closed-loop systems]	C
29	Mathematical skills (theoretical aspects) [Game Theory]	C
31	Mathematical skills (theoretical aspects) [Latent Semantic Analysis]	C
30	Mathematical skills (theoretical aspects) [Latent Dirichlet Allocation algorithm]	C

Source: Own study



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In the next stage of the implemented methodology, the team of experts assigned the competencies to three groups based on their substantive content and planned course topics:

- Course 1: Advanced using of spreadsheet to analyze logistics data;
- Course 2: Business Intelligence;
- Course 3: Statistical method to analysing a logistics data.

The allocation of competencies (along with their ranking in the ABC classification) is presented in Tables 6-8.

Table 6. ABC Ranking of BAS for Course 1(Advanced using of spreadsheet to analyze logistics data)

No.	BAS skills	Competence	Course 1
1	Informatic skills (business intelligence tools)	Microsoft Excel	A
2	Informatic skills (business intelligence tools)	Spreadsheet analysis	A
3	Managerial skills	Supply Chain and Sourcing	A
4	Managerial skills	Inventory Management	A
5	Mathematical skills (theoretical aspects)	Transport Optimization	A
6	Applied math & stat	Optimization in Supply Chain Management	A
7	Applied math & stat	Forecasting Techniques	A
8	Applied math & stat	Data Visualisation Methods	A
9	Informatic skills (simulations)	Simulation of Logistics and Supply Chains	A
10	Managerial skills	Cost-Benefit Analysis for Business	A
11	Managerial skills	Controlling in Supply Chain Management	A
12	Managerial skills	Outsourcing (Make of Buy)	B
13	Mathematical skills (theoretical aspects)	Network Optimization	B
14	Applied math & stat	Optimization models and heuristic methods for managing production systems	B



15	Mathematical skills (theoretical aspects)	Dynamic Simulation of closed-loop systems	C
16	Mathematical skills (theoretical aspects)	Modelling and Simulation of Dynamic Systems	C

Source: Own study

Table 7. ABC Ranking of BAS skills for Course 2 (Business Intelligence)

No.	BAS skills	Competence	Course 2
1	<i>Informatic skills (Management systems)</i>	<i>Enterprise Resource Planning Systems (ERP)</i>	A
2	<i>Managerial skills</i>	<i>Sales and service management</i>	A
3	<i>Managerial skills</i>	<i>e-logistics</i>	A
4	<i>Mathematical skills (theoretical aspects)</i>	<i>Understanding and interpreting the data</i>	A
5	<i>Applied math & stat</i>	<i>Data Visualisation Methods</i>	A
6	<i>Informatic skills (simulations)</i>	<i>Simulation of Logistics and Supply Chains</i>	A
7	<i>Applied math & stat</i>	<i>Business Data Analytics</i>	A
8	<i>Informatic skills (business intelligence tools)</i>	<i>Big Data Research Methods</i>	A
9	<i>Informatic skills (business intelligence tools)</i>	<i>Big Data Systems</i>	A
10	<i>Informatic skills (business intelligence tools)</i>	<i>Software tools in logistics</i>	A
11	<i>Informatic skills (Databases)</i>	<i>Software tools for data management</i>	A
12	<i>Managerial skills</i>	<i>Data Management and Business Intelligence</i>	A
13	<i>Informatic skills (Management systems)</i>	<i>Integrated enterprise management (SAP, ERP)</i>	A
14	<i>Mathematical skills (theoretical aspects)</i>	<i>Statistics for Business Analytics</i>	B
15	<i>Managerial skills</i>	<i>Digital economics</i>	B
16	<i>Applied math & stat</i>	<i>Data Ethics and Data Security</i>	B
17	<i>Applied math & stat</i>	<i>Statistics for Business Analytics</i>	B
18	<i>Applied math & stat</i>	<i>Creation of Reports and Dashboards</i>	B
19	<i>Informatic skills (simulations)</i>	<i>Business Process Modelling</i>	B
20	<i>Informatic skills (data analytics)</i>	<i>Data mining</i>	B
21	<i>Informatic skills (Different software tools)</i>	<i>GIS in logistics</i>	B
22	<i>Informatic skills (Databases)</i>	<i>Data Mining and Data Warehousing</i>	B





23	<i>Informatic skills (visualisation)</i>	<i>Power BI</i>	<i>B</i>
24	<i>Managerial skills</i>	<i>Information Systems & Business Process Management</i>	<i>C</i>
25	<i>Mathematical skills (theoretical aspects)</i>	<i>Process analysis and Petri nets</i>	<i>C</i>
26	<i>Mathematical skills (theoretical aspects)</i>	<i>Neural networks</i>	<i>C</i>
27	<i>Mathematical skills (theoretical aspects)</i>	<i>Decision trees</i>	<i>C</i>
28	<i>Mathematical skills (theoretical aspects)</i>	<i>Pattern recognition</i>	<i>C</i>
29	<i>Mathematical skills (theoretical aspects)</i>	<i>Genetic algorithms</i>	<i>C</i>
30	<i>Applied math & stat</i>	<i>Stochastic Simulation</i>	<i>C</i>
31	<i>Informatic skills (simulations)</i>	<i>Discrete event simulation</i>	<i>C</i>
32	<i>Informatic skills (visualisation)</i>	<i>Tableau</i>	<i>C</i>

Source: Own study

Table 8. ABC Ranking of BAS skills for Course 3 (Statistical method to analysing a logistics data)

No.	BAS skills	Competence	Course 3
1	Mathematical skills (theoretical aspects)	Understanding and interpreting the data	A
2	Informatic skills (simulations)	Simulation of Logistics and Supply Chains	A
3	Informatic skills (programming)	Artificial Intelligence and Machine Learning	A
4	Managerial skills	Supply Chain Risk Management	A
5	Mathematical skills (theoretical aspects)	Optimization Methods and Tools	A
6	Mathematical skills (theoretical aspects)	Discovering regularities in data	B
7	Informatic skills (data analytics)	Business Analytics Foundations including R, SQL, and Power BI software	B
8	Applied math & stat	Vehicle routing	B
9	Managerial skills	Mathematical models for Supply Chain Management	B
10	Managerial skills	Six Sigma Techniques	B
11	Mathematical skills (theoretical aspects)	Operations Research	B
12	Mathematical skills (theoretical aspects)	Statistics for Business Analytics	B
13	Mathematical skills (theoretical aspects)	Advanced Mathematics for Decision Making	B





14	Mathematical skills (theoretical aspects)	Large Scale Optimization	B
15	Mathematical skills (theoretical aspects)	Correlation analysis	B
16	Applied math & stat	Statistics for Business Analytics	B
17	Applied math & stat	Last Mile Delivery: data analytics and models	B
18	Applied math & stat	Lean Six Sigma Statistical control	B
19	Informatic skills (data analytics)	Python for Data Science	B
20	Informatic skills (programming)	General programming	B
21	Mathematical skills (theoretical aspects)	Introductory statistics	C
22	Applied math & stat	Sampling and Experimental Design	C
23	Mathematical skills (theoretical aspects)	Hypothesis testing	C
24	Mathematical skills (theoretical aspects)	Linear Regression with Single and Multiple Regressors	C
25	Informatic skills (data analytics)	Data analysis and R software packages	C
26	Informatic skills (data analytics)	Statistical data processing SPSS	C
27	Managerial skills	Econometrics	C
28	Mathematical skills (theoretical aspects)	Combinatorial optimization and metaheuristics	C
29	Mathematical skills (theoretical aspects)	Integer Programming	C
30	Mathematical skills (theoretical aspects)	Optimization using metaheuristics	C
31	Mathematical skills (theoretical aspects)	Multivariate analysis	C
32	Applied math & stat	Spatial Statistics	C
33	Applied math & stat	Heuristics in analytics	C

Source: Own study

Tables 9-11 present the results of research conducted among students (including graduates) and academic teachers - A2.2 and managers of logistics and production enterprises (including entrepreneurs) - A2.3. In accordance with the adopted methodology for identifying the competency gap, the results are presented:

- Median importance from the perspective of managers of logistics and manufacturing companies;



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- Total percentage of academic staff responses: "Agree";
- Total percentage of student responses: "Very important" and "Important."

Competencies in tables 9-11 are color-coded according to their assignment to the competency area in accordance with the scheme:

- Managerial skills – green colour;
- Mathematical skills (theoretical aspects) – pink colour;
- Applied math & stat – blue colour;
- IT skills – orange colour.

Tables 9-11 present only those competencies for which the identification of the competency gap met the assumptions presented in the methodology.

Table 9. Results of the research of BAS skills for Course 1 (Advanced using of spreadsheet to analyze logistics data)

Competence	Companies -Median importance	Students – Important + Very important	Academic teachers - Agree
Controlling in Supply Chain Management	4	85,3%	79,6%
Cost-Benefit Analysis for Business	4	83,6%	85,2%
Supply Chain and Sourcing	4	86,9%	84,3%
Inventory Management	4	85,8%	87,0%
Outsourcing (Make of Buy)	4	78,2%	71,3%
Modelling and Simulation of Dynamic Systems	4	57,9%	52,8%
Network Optimization	4	73,0%	64,8%
Transport Optimization	4	86,4%	75,0%
Optimization in Supply Chain Management	4	87,6%	88,0%
Forecasting Techniques	4	82,5%	85,2%
Data Visualisation Methods	4	76,9%	81,5%
Optimization models and heuristic methods for managing production systems	4	62,0%	67,6%
Simulation of Logistics and Supply Chains	4	83,4%	89,8%
Spreadsheet analysis	4	87,2%	86,1%
Microsoft Excel	5	93,4%	87,0%





Table 10. Results of the research of BAS skills for Course 1 (Advanced using of spreadsheet to analyze logistics data) Statistical method to analysing a logistics data)

Competence	Companies -Median importance	Students – Important + Very important	Academic teachers - Agree
e-logistics	4	82,5%	81,5%
Neural networks	3	47,3%	53,7%
Decision trees	4	65,9%	69,4%
Understanding and interpreting the data	4	78,3%	80,6%
Statistics for Business Analytics	4	78,2%	85,2%
Data Ethics and Data Security	4	69,4%	65,7%
Discrete event simulation	4	56,9%	52,8%
Big Data Research Methods	4	81,4%	75,9%
Software tools in logistics	4	85,1%	80,6%
Software tools in logistics	4	82,9%	76,9%
GIS in logistics	4	73,8%	67,6%
Software tools for data management	4	76,2%	69,4%
Power BI	4	41,5%	65,7%
Tableau	3	37,4%	48,1%
Enterprise Resource Planning Systems (ERP)	4	79,8%	81,5%
Integrated enterprise management (SAP, ERP)	4	77,5%	83,3%

Source: Own study

**Table 11. Results of the research of BAS skills for Course 3 (Statistical method to analysing a logistics data)**

Competence	Companies -Median importance	Students – Important + Very important	Academic teachers - Agree
OperationsResearch	4	74,2%	78,7%
Introductory statistics	4	73,3%	71,3%
Statistics for Business Analytics	4	74,1%	80,6%
Discovering regularities in data	4	67,9%	71,3%
Hypothesis testing	4	58,8%	65,7%
Linear Regression with Single and Multiple Regressors	3	48,4%	57,4%
Sampling and Experimental Design	4	53,6%	54,6%
Lean Six Sigma Statistical control	4	50,7%	57,4%
Business Analytics Foundations including R, SQL, and Power BI software	4	59,8%	65,7%
Statistical data processing SPSS	4	52,5%	58,3%
Artificial Intelligence and Machine Learning	4	71,4%	62,0%
SQL	4	56,8%	64,8%

Source: Own study

Taking into account the results presented in Tables 9-11, recommended competencies were developed for each of the three courses under development. These competencies, broken down by course, are presented in Chapter 4 of this report.

A detailed analysis of the results for all competencies is presented in the attachment to this report: Attachment_1_BAS4SC_WP2_Analysis in the sheet: Analysis_ALL.



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4. Recommendation of TOP 10 skills for each courses

Based on the survey responses, ranking and literature review on a given courses topic in the Tables 12-14 the proposal for a top 10 skills is provided.

Table 12. Top 10 skills for course 1

No.	Course 1	Partner
1	Microsoft Excel Spreadsheet analysis	PUT
2	Data Visualisation Methods	WSL
3	Optimization in Supply Chain Management	PUT
4	Controlling in Supply Chain Management Cost-Benefit Analysis for Business	WSL
5	Supply Chain and Sourcing Outsourcing (Make of Buy)	WSL
6	Outsourcing (Make of Buy) Simulation of Logistics and Supply Chains Modelling and Simulation of Dynamic Systems	PUT
7	Network Optimization (Gravity Point) Transport Optimization	WSL
8	Forecasting Techniques	PUT
9	Inventory Management	PUT
10	Optimization models and heuristic methods for managing production systems Transport Optimization	WSL

Source: Own study

Table 13. Top 10 skills for course 2

No.	Course 2	Partner
1	Understanding and interpreting the data, Business Data Analytics, Data mining Statistics for Business Analytics	NS
2	e-logistics	WSL
3	Enterprise Resource Planning Systems (ERP) Integrated enterprise management (SAP, ERP)	EFOS
4	Software tools for data management Software tools in logistics	EFOS
5	Business Process Management Simulation of Logistics and Supply Chains Discrete event simulation	EFOS
6	Data Visualisation Methods, Power BI, Tableau	EFOS
7	GIS in logistics	EFOS
8	Data Ethics and Data Security	EFOS
9	Big Data Research Methods Decision trees	NS
10	Neural networks	NS

Source: Own study



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Table 14. Top 10 skills for course 3

No.	Course 3	
1	Introductory statistics	UM
2	Statistics for Business Analytics	UM
3	Understanding and interpreting the data; Sampling and Experimental Design; Hypothesis testing; Discovering regularities in data	UM
4	Lean Six Sigma Statistical control; Distributions and Probability; Simulation, modeling and analysis in Logistics and Supply Chains	UM
5	Linear Regression with Single and Multiple Regressors	UM
6	Introduction to SQL – Introduction to Operations Research	UM
7	Statistical data processing SPSS	UM/NS
8	Business Analytics Foundations including R, SQL, and Power BI software	NS
9	Demand forecasting, visualising and feature engineering of time series in supply chains	NS
10	Artificial Intelligence and Machine Learning in Operations Research	NS

Source: Own study

The final step in the methodology for identifying the competency gap and key competencies was to check whether the selected competencies stood out from those not assigned to any course in terms of two key criteria:

- Importance/relevance determined by company managers;
- Approval from academic teachers for the inclusion of these competencies in newly developed courses.

The summary analysis did not include a criterion related to student responses due to the higher weight given to the importance of competencies by business managers and academics. The results of the analysis are presented in Table 15.





Table 15. Top 10 skills for course 3

Course	Companies - Average Median importance	Academic teachers - Average Agree
Not included in course	3,71	60,14%
C1	4,07	79,01%
C2	3,88	71,12%
C3	3,92	65,66%

Source: Own study

According to the data presented in Table 15, the average median score for competencies included in each course (C1, C2, C3) is higher than for competencies not included in the courses. The average percentage of academic teachers' agreement to include these competencies in the courses is also higher for competencies included in the courses. Both of these observations confirm the correctness of the selection of competencies that will inform the content of the courses created in WP3 of the BAS4SC project.





Summary

The competency sets presented in Tables 12-14 constitute the recommended topics for courses that will be developed in WP3 of the project. Appropriate teaching tools will be selected for each topic, enabling students to acquire the expected competencies.

Detailed results of the competency survey among students (including graduates), academic teachers, and managers of logistics and manufacturing companies, along with the methodology used to identify competency gaps and allocate selected competencies to the three courses, are presented in the appendix to this report.: Attachment_1_BAS4SC_WP2_Analysis.

Attachments

- Attachment_1_BAS4SC_WP2_Analysis

