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Description of the IO2

The game-based software application TRELOGIC is developed within the frame of IO2. The methodological approach uses 4-step game-based training: (1) formulation of problem; (2) formulation of alternative routes for the delivery of goods within the frame of case study and search of the necessary data; (3) formulation of criteria for choosing the best route; (4) the practical use of the multi-criteria decision making on the base of developed software tool TRELOGIC.

To achieve planned results of output IO2 following activities were implemented and reported:

1. The algorithm for TRELOGIC application for T&L VET was developed.
2. The content and set of information materials for TRELOGIC application for T&L VET was developed.
3. The educational information as essential background knowledge for TRELOGIC application was prepared.
4. The pilot software of the TRELOGIC system was designed.
5. The detailed TRELOGIC Manual in English was developed.
6. The TRELOGIC Manuals in the local languages of the partners were developed.
7. The video demo of TRELOGIC application was developed.
8. The TRELOGIC application was tested during pilot training sessions.

The TRELOGIC system is an information product prepared as computer application. It contains the elements of network technologies, databases and role strategic games based on the simulation modelling. The software provides opportunity for remote access to application via Internet.

It gives opportunity for training and testing the professional skills of specialists by means of modelling different complex situations, taking into account real conditions. The simulation tool might be used as a tool for distant learning using the opportunities of e-learning that allows considerably increasing the contingent of trainees from different countries. The practice of the TRELOGIC game based learning system can be used for increasing readiness of VET students and SME professionals for working in the single European T&L market.

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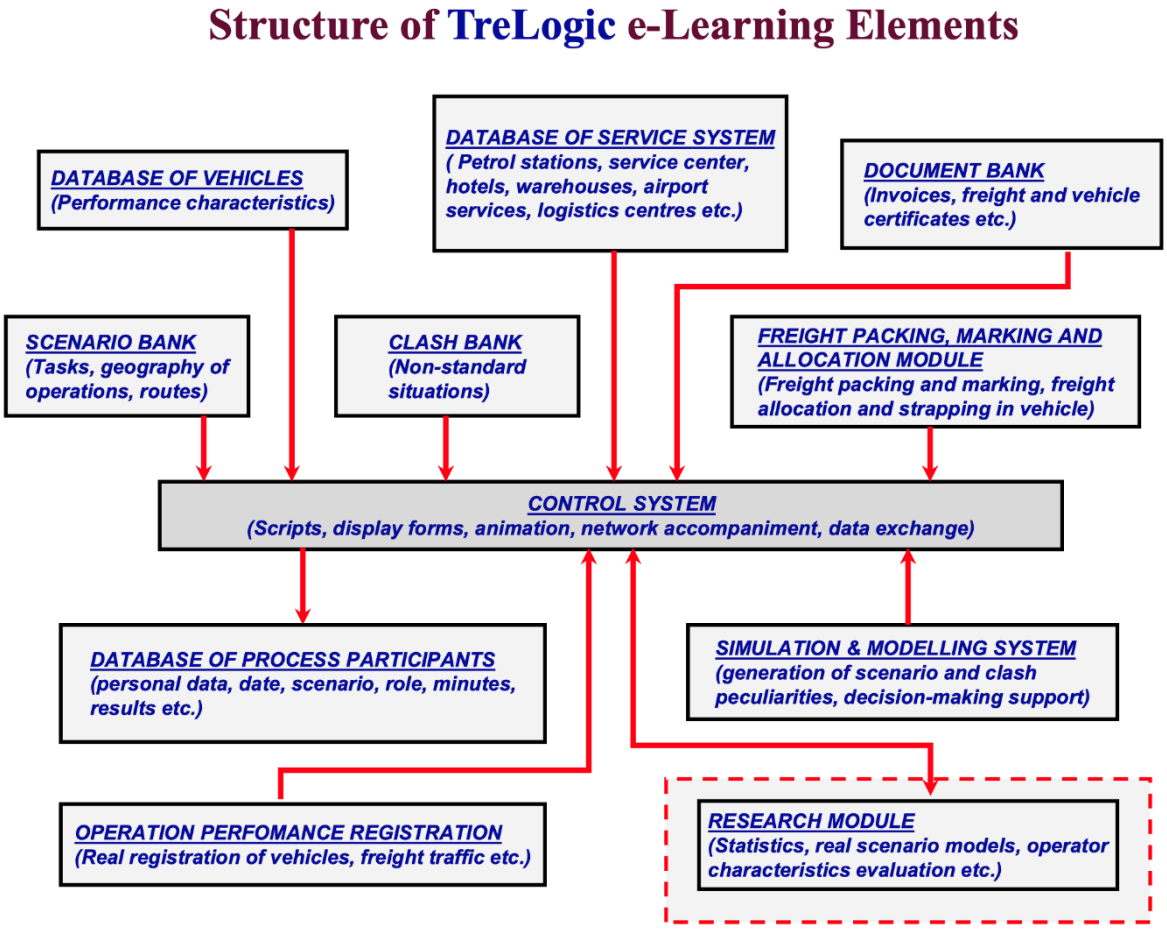
Results of intellectual output IO2

To achieve planned results of output IO2 following activities were implemented and reported:

1. The algorithm for TRELOGIC application for T&L VET was developed (Annex 1).
2. The content and set of information materials for TRELOGIC application for T&L VET was developed (Annex 2).
3. The educational information as essential background knowledge for TRELOGIC application was prepared (Annex 3).
4. The pilot software of the TRELOGIC system was designed (Annex 4).
5. The detailed TRELOGIC Manual in English was developed (Annex 5).
6. The TRELOGIC Manuals in the local languages of the partners were developed (Annex 6).
7. The video demo of TRELOGIC application was developed (Annex 7).

Annex 1.
The structure of TRELOGIC application and algorithm for TRELOGIC game based training for T&L VET



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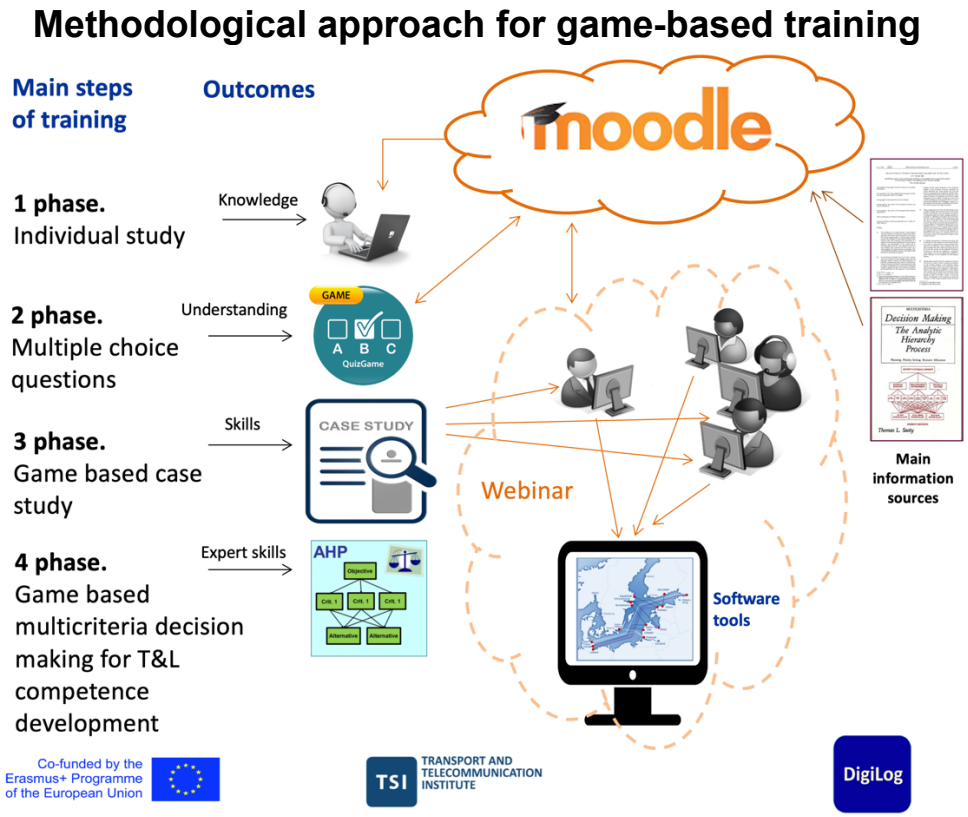

Annex 2.
The content and set of information materials for TRELOGIC application for T&L VET

Within the frame of IO2 each partner prepared set of national-oriented information materials for case studies, which will be used as background for game training in multinational environment of transport and logistics.

Each partner collect initial nation-oriented information kit needed for development case studies for IO2. This information kit includes the next core information:

- Three core objects of national transport and logistics infrastructure in various cities (sea and dry ports, raw or production hubs, logistics centres, and others), one of which should be obligatory sea port.
- For selected objects, indicate the structure of goods, their volume and the modes and types of transport means involved in their transportation.
- Free-form description of selected transport infrastructure objects.
- Web sites of objects of the selected transport infrastructure.
- For used modes and types of transport specify tariffs for transportation of various cargo.
- Specify the national characteristics of the customs conditions.
- Identify public and commercial information systems used to obtain information about the characteristics of the transportation of goods and their conditions in the territory of the partner countries.
- Specify the systems that provide service to track the location and status of cargo ot the territory of the partner country.

The composition of the information in the specified information kit can be updated in the process of performing work under practical use of game-based application.

Annex 3.
The educational information for TRELOGIC application

The educational information for TRELOGIC application is contained in the subject card “Game based multi-criteria decision making for T&L competence development” (file with title “Annex 3”).

Annex 4.
The pilot software of the TRELOGIC application

A software application has been developed. Examples of user interfaces ща application are shown below.

Input Data for AHP Analysis of the route of transportation by KPI (5 criteria)

n	Criteria	Comment
1	Economics	• Direct transportation costs for 40'DC container, US dollars • Fluctuations of costs during the year, average in % • Estimated time of transportation, days • Possibilities for custom clearance (quantity of different possibilities) • Transportation risks (risk of delay, theft, damages), probability (expert evaluation)
2	Geography	• Quantity of custom/border points on the route • Presence of regular shipping Lines/railway services/trucks in the loading area (points 1-100%, expert evaluation) • Transportation distance of post-carriage in sum (^km in average)* • Possibility to change transportation route in the cluster group (quantity of ports/border cross points etc), transportation mode (quantitv) • Quantity of transit countries on the route
3	Infrastructure	• Capacity of ports and/or border points (congestions as the result) (100%-good, 0% - bad, expert evaluation) • Quantity of transhipments on the route • Quality of transport-related infrastructure (100% - good,0% - bad) • Availability of bonded warehouses on the route (100% - a lot, 0% - no any) • Availability of good railway services on the route (100% - big availability, 0% - small)
4	Technology	• Availability of necessary equipment on the route (% in cases which available, expert evaluation) • Availability of necessary transport on the route (% in cases which available, expert evaluation) • Ability to track and trace on the route (100% - good, 0% no any, expert evaluation) • Electronic invoices and customs procedure (100% - good, 0% - bad, expert evaluation) • Terminal operations efficiency (100% - good, 0% - bad, expert evaluation)
5	Ulterior factors	• Existing cargo flows (100% - much, 0% no any, expert evaluation) • People competences and quality of logistics services in transhipment countries on the route (100% - good, 0% - bad) • Quantity of used languages in the country/city of transhipment (average), expert evaluation • Additional added value services on the route (100% - much, 0% - no any, expert evaluation) • Longstanding trading spirit of ports of transhipment (route) (100% - much, 0% - no any, expert evaluation)

Rules of Assessment of Intensity of importance

STRONG	Definition	WEAK	Explanation
1	Equal importance	1	Two elements contribute equally to the objective
2	Intermediate value	1/2	
3	Moderate importance	1/3	Experience and judgment slightly favor one element over another
4	Intermediate value	1/4	
5	Strong Importance	1/5	Experience and judgment strongly favor one element over another
6	Intermediate value	1/6	
7	Very strong importance	1/7	One element is favored very strongly over another, it dominance is demonstrated in practice
8	Intermediate value	1/8	
9	Extreme importance	1/9	The evidence favoring one element over another is of the highest possible order of affirmation

2, 4, 6, 8 can be used to express intermediate values

IMPORTANCE OF CRITERIA (PAIR COMPARISON):

Only input data in the light green fields!

Please compare the importance of the elements in relation to the objective and fill in the table: Which element of each pair is more important, LEFT or RIGHT, and how much more on a scale (1-9) in EXCELLENCE or (1-1/9) in WEAKNESS as given below. Once completed, you might adjust highlighted comparisons to improve consistency.

LEFT criteria			Score	RIGHT criteria
Economics	1,000	vs	1,000	Geography
Economics	1,000	vs	1,000	Infrastructure
Economics	1,000	vs	1,000	Technology
Economics	1,000	vs	1,000	Ulterior factors
Geography	1,000	vs	1,000	Infrastructure
Geography	1,000	vs	1,000	Technology
Geography	1,000	vs	1,000	Ulterior factors
Infrastructure	1,000	vs	1,000	Technology
Infrastructure	1,000	vs	1,000	Ulterior factors
Technology	1,000	vs	1,000	Ulterior factors

IMPORTANCE OF CRITERIA PAIR COMPARISON MATRIX

	Economics	Geography	Infrastructure	Technology	Ulterior factors
Economics	1,000	1,000	1,000	1,000	1,000
Geography	1,000	1,000	1,000	1,000	1,000
Infrastructure	1,000	1,000	1,000	1,000	1,000
Technology	1,000	1,000	1,000	1,000	1,000
Ulterior factors	1,000	1,000	1,000	1,000	1,000

Conformity Relation = 0,00%

Logic check: If this statement is true, you are on the right track.

Geography | is less important than | Economics

Input Data for AHP Analysis of the route of transportation by KPI (5 criteria)

n	Criteria	Comment
1	Economics	• Direct transportation costs for 40'DC container, US dollars • Fluctuations of costs during the year, average in % • Estimated time of transportation, days • Possibilities for custom clearance (quantity of different possibilities) • Transportation risks (risk of delay, theft, damages), probability (expert evaluation)
2	Geography	• Quantity of custom/border points on the route • Presence of regular shipping Lines/railway services/trucks in the loading area (points 1-100%, expert evaluation) • Transportation distance of post-carriage in sum (~km in average)* • Possibility to change transportation route in the cluster group (quantity of ports/border cross points etc), transportation mode (quantity) • Quantity of transit countries on the route
3	Infrastructure	• Capacity of ports and/or border points (congestions as the result) (100%-good, 0% - bad, expert evaluation) • Quantity of transhipments on the route • Quality of transport-related infrastructure (100% - good,0% - bad) • Availability of bonded warehouses on the route (100% - a lot, 0% - no any) • Availability of good railway services on the route (100% - big availability, 0% - small)
4	Technology	• Availability of necessary equipment on the route (% in cases which available, expert evaluation) • Availability of necessary transport on the route (% in cases which available, expert evaluation) • Ability to track and trace on the route (100% - good, 0% no any, expert evaluation) • Electronic invoices and customs procedure (100% - good, 0% - bad, expert evaluation) • Terminal operations efficiency (100% - good, 0% - bad, expert evaluation)
5	Ulterior factors	• Existing cargo flows (100% - much, 0% no any, expert evaluation) • People competences and quality of logistics services in transhipment countries on the route (100% - good, 0% - bad) • Quantity of used languages in the country/city of transhipment (average), expert evaluation • Additional added value services on the route (100% - much, 0% - no any, expert evaluation) • Longstanding trading spirit of ports of transhipment (route) (100% - much, 0% - no any, expert evaluation)

Rules of Assessment of Intensity of importance

STRONG	Definition	WEAK	Explanation
1	Equal importance	1	Two elements contribute equally to the objective
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8	Intermediate value	1/8	
9	Extreme importance	1/9	The evidence favoring one element over another is of the highest possible order of affirmation

2, 4, 6, 8 can be used to express intermediate values

ROUTE PREFERENCES (PAIR COMPARISON):

A	RAUMA	Moscow - port Rauma (Finland) - Stockholm
B	PALDISKI	Moscow - port Paldiski (Estonia) - Stockholm
C	RIGA	Moscow - port Riga (Latvia) - Stockholm

Only input data in the light green fields!

Please compare the importance of the elements in relation to the objective and fill in the table: Which element of each pair is more important, LEFT or RIGHT, and how much more on a scale (1-9) in EXCELLENCE or (1-1/9) in WEAKNESS as given below. Once completed, you might adjust highlighted comparisons to improve consistency.

ECONOMICS:

LEFT criteria	Score		Score	RIGHT criteria
RAUMA	1,000	vs	1,000	PALDISKI
RAUMA	1,000	vs	1,000	RIGA
PALDISKI	1,000	vs	1,000	RIGA
Conformity Relation =	0,00%			

	RAUMA	PALDISKI	RIGA	Total
A	1,000	1,000	1,000	3,000
B	1,000	1,000	1,000	3,000
C	1,000	1,000	1,000	3,000
sum	3,000	3,000	3,000	Weights
A	0,333	0,333	0,333	0,3333
B	0,333	0,333	0,333	0,3333
C	0,333	0,333	0,333	0,3333
checksum	1,000	1,000	1,000	1,000

GEOGRAPHY:

LEFT criteria	Score		Score	RIGHT criteria
RAUMA	1,000	vs	1,000	PALDISKI
RAUMA	1,000	vs	1,000	RIGA
PALDISKI	1,000	vs	1,000	RIGA
Conformity Relation =	0,00%			

	RAUMA	PALDISKI	RIGA	Total
A	1,000	1,000	1,000	3,000
B	1,000	1,000	1,000	3,000
C	1,000	1,000	1,000	3,000
sum	3,000	3,000	3,000	Weights
A	0,333	0,333	0,333	0,3333
B	0,333	0,333	0,333	0,3333
C	0,333	0,333	0,333	0,3333
checksum	1,000	1,000	1,000	1,000

INFRASTUCTURE:

LEFT criteria	Score		Score	RIGHT criteria
RAUMA	1,000	vs	1,000	PALDISKI
RAUMA	1,000	vs	1,000	RIGA
PALDISKI	1,000	vs	1,000	RIGA
Conformity Relation =	0,00%			

	RAUMA	PALDISKI	RIGA	Total
A	1,000	1,000	1,000	3,000
B	1,000	1,000	1,000	3,000
C	1,000	1,000	1,000	3,000
sum	3,000	3,000	3,000	Weights
A	0,333	0,333	0,333	0,3333
B	0,333	0,333	0,333	0,3333
C	0,333	0,333	0,333	0,3333
checksum	1,000	1,000	1,000	1,000

TECHNOLOGY:

LEFT criteria	Score		Score	RIGHT criteria
RAUMA	1,000	vs	1,000	PALDISKI
RAUMA	1,000	vs	1,000	RIGA
PALDISKI	1,000	vs	1,000	RIGA
Conformity Relation =	0,00%			

	RAUMA	PALDISKI	RIGA	Total
A	1,000	1,000	1,000	3,000
B	1,000	1,000	1,000	3,000
C	1,000	1,000	1,000	3,000
sum	3,000	3,000	3,000	Weights
A	0,333	0,333	0,333	0,3333
B	0,333	0,333	0,333	0,3333
C	0,333	0,333	0,333	0,3333
checksum	1,000	1,000	1,000	1,000

ULTERIOR FACTORS:

LEFT criteria	Score		Score	RIGHT criteria
RAUMA	1,000	vs	1,000	PALDISKI
RAUMA	1,000	vs	1,000	RIGA
PALDISKI	1,000	vs	1,000	RIGA
Conformity Relation =	0,00%			

	RAUMA	PALDISKI	RIGA	Total
A	1,000	1,000	1,000	3,000
B	1,000	1,000	1,000	3,000
C	1,000	1,000	1,000	3,000
sum	3,000	3,000	3,000	Weights
A	0,333	0,333	0,333	0,3333
B	0,333	0,333	0,333	0,3333
C	0,333	0,333	0,333	0,3333
checksum	1,000	1,000	1,000	1,000

AHP Analysis for selecting the route of transportation that satisfy generalized KPI (5 criteria)

IMPORTANCE OF CRITERIA

	Economics	Geography	Infrastructure	Technology	Ulterior factors
Economics	1,000	1,000	1,000	1,000	1,000
Geography	1,000	1,000	1,000	1,000	1,000
Infrastructure	1,000	1,000	1,000	1,000	1,000
Technology	1,000	1,000	1,000	1,000	1,000
Ulterior factors	1,000	1,000	1,000	1,000	1,000
sum	5,000	5,000	5,000	5,000	5,000

Logic check:

If this statement is true, you are on the right track.

Geography is less important than Economics

	Economics	Geography	Infrastructure	Technology	Ulterior factors	Weights
Economics	0,200	0,200	0,200	0,200	0,200	0,2000
Geography	0,200	0,200	0,200	0,200	0,200	0,2000
Infrastructure	0,200	0,200	0,200	0,200	0,200	0,2000
Technology	0,200	0,200	0,200	0,200	0,200	0,2000
Ulterior factors	0,200	0,200	0,200	0,200	0,200	0,2000
checksum	1,000	1,000	1,000	1,000	1,000	1,000
				Conformity Relation =		0,00%

EVALUATION OF ROUTES (CHOICES):

	Economics	Geography	Infrastructure	Technology	Ulterior factors
RAUMA	3,000	3,000	3,000	3,000	3,000
PALDISKI	3,000	3,000	3,000	3,000	3,000
RIGA	3,000	3,000	3,000	3,000	3,000
sum	9,000	9,000	9,000	9,000	9,000

Note: Be sure that the high score signifies the most desireable

ROUTES:

RAUMA	Moscow - port Rauma (Finland) - Stockholm
PALDISKI	Moscow - port Paldiski (Estonia) - Stockholm
RIGA	Moscow - port Riga (Latvia) - Stockholm

COLUMN-NORMALIZED MATRIX:

	Economics	Geography	Infrastructure	Technology	Ulterior factors
RAUMA	0,333	0,333	0,333	0,333	0,333
PALDISKI	0,333	0,333	0,333	0,333	0,333
RIGA	0,333	0,333	0,333	0,333	0,333
checksum	1,000	1,000	1,000	1,000	1,000

	Weights
Economics	0,200
Geography	0,200
Infrastructure	0,200
Technology	0,200
Ulterior factors	0,200

SCORES:

RAUMA	0,333	◄- Highest is recommended
PALDISKI	0,333	◄- Highest is recommended
RIGA	0,333	◄- Highest is recommended
checksum	1,000	

Annex 5.
The detailed TRELOGIC Manual in English

Guideline for use of E-learning game-based technology for training and education of transport and logistics specialists (TRELOGIC) is in the file with title “Annex 5”.

Annex 6.
The TRELOGIC Manuals in the local languages of the partners

The TRELOGIC Manuals in Estonian,Finnish, Latvian, Swedich languages included in files with titles “Annex 6”.

Annex 7.
The video demo of TRELOGIC application

The video demo of TRELOGIC application was developed. The file has size about 38 MB.
The file can be downloaded from the link:
https://www.dropbox.com/s/s9ccauqp7v94bna/VIDEO_AHP_TreLogic_DigiLog-2021.avi?dl=0

Guideline for use of

E-learning game-based technology for training and education of transport and logistics specialists (TRELOGIC)

1. Introduction

The Baltic region is remarkable for its economically advantageous geographical position within the Eurasian transport system. Reconfiguring supply chains around customers has led to the necessity for more flexible and adaptive formation system of transport and logistics links with assistance of decision support system.

There are seven typical steps of multi-criteria decision making for transportation process:

- to identify transportation alternatives;
- to establish performance criteria;
- to establish relative importance of performance criteria;
- to establish commensurate scale for measuring levels of each criteria;
- using the established scale, quantify level (impact) of each criterion for each alternative action;
- to establish the combined impact of the different criteria for each alternative;
- to determine the most satisfying alternative.

2. Methodological approach

The methodological approach used of the game-based training method TRELOGIC involves a 4-step learning process for case study:

A. The formulation of a practical problem, to find the source of data for its solution. Formulation of alternative routes for the delivery of goods within the frame of case study. Search of the necessary data.
B. Formulation of criteria for choosing the best route. Study opportunities of the Logistics Performance Index (LPI) as an interactive benchmarking tool created to help professionals in logistics identify the challenges and opportunities they face in their performance on trade logistics.
C. Study The Analytic Hierarchy Process (AHP) as method for multicriteria decision making.
D. The practical use of the AHP method to solve the problem formulated in the case study on the base of developed software tool. Individual and group expert application of software.

3. Description of learning process

3.1. Game based case study. The formulation of a practical problem, to find the source of data for its solution

A container block train from China should arrive in Sweden (Container Terminal of the Stockholm port). Terminal-logistic centre of the Moscow region is the transit point of the route. Then there

are three alternatives to achieve Stockholm through Riga (Latvia), Muuga (Estonia) or Rauma (Finland):

- Moscow - port Rauma (Finland) - Stockholm
- Moscow - port Muuga (Estonia) - Stockholm
- Moscow - port Riga (Latvia) – Stockholm

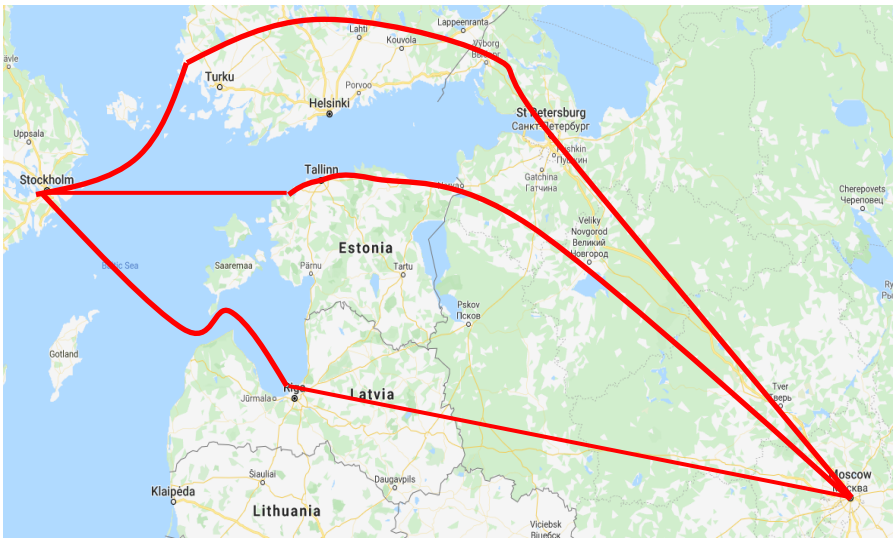

Fig.1. Three alternative routes

The following information and assumptions are used:

- all tariffs for transportation by one mode of transport for all routes are the same,
- all service charges in all ports are the same,
- the distances between the departure point, intermediate points and the delivery point are determined using Google Map.
- Information about the LPI for countries through which alternative routes run is presented on the website of World Bank (https://lpi.worldbank.org/about) .

3.2. Formulation of criteria for choosing the best route

Taxonomy of key performance indicators (KPI) for this model can be described by set of parameters in five clusters – Economics, Geography, Infrastructure, Technology and Ulterior factors. Metrics for both quantitative and qualitative KPIs are proposed in [4] and described in additional instruction. Additionally, students can use Logistics Performance Index (LPI) as KPI. Students should analyse KPI in order to evaluate which of the factors for the case under consideration will be more influence in pairwise comparison.

3.3. Study the Analytic Hierarchy Process (AHP) as method for Multi-criteria decision making

The analytic hierarchy process (AHP) is a structured technique for organizing and analysing complex decisions, based on mathematics and psychology. It represents the most accurate approach for quantifying the weights of criteria. Individual experts' experiences are utilized to estimate the relative magnitudes of factors through pair-wise comparisons. Each of the respondents has to compare the relative importance between the two items under special designed questionnaire.

AHP is a multi-criteria model that provides a methodology for comparing alternatives by structuring criteria into a hierarchy, providing for pair-wise comparisons of criteria at the lowest level of the hierarchy to be entered by the user, and synthesizing the results into a single numerical value.
Students should study the AHP method and analyse KPI in order to evaluate which of the factors for the case under consideration will be more influence in pairwise comparison [1-3].

3.4. The practical use of the TreLogic to solve the problem formulated in the case study on the base of developed software tool

There is two step procedure of the practical use of the TreLogic.
1. Individual work. Using the software Trelogic, student compare each alternative route by all criteria and give them an expert assessment in accordance with the instructions.
2. Group work (face-to-face workshop or webinar). Students discuss with other participants of the game their expert assessments and the reasons for their differences.

4. References

1. Kcb Kadri, Kardi Teknomo. Analytic Hierarchy Process (AHP) Tutorial. https://www.academia.edu/30117750/ANALYTIC_HIERARCHY_PROCESS_AHP_TUTORIAL
2. Matteo Brunelli. Introduction to the Analytic Hierarchy Process, 2015. https://core.ac.uk/download/pdf/80714029.pdf
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4. Igor Kabashkin, Jelena Luchina. Development of the Model of Decision Support for Alternative Choice in the Transportation Transit System. Transport and Telecommunication. 2015, Volume 16, No 1, pp. 61–72, ISSN 1407-6160, DOI: 10.1515/ttj-2015-0007. https://content.sciendo.com/view/journals/ttj/16/1/article-p61.xml

Mängude teooria põhise e-õppe (TRELOGIC) juhend transpordi ja logistika spetsialistide koolitamiseks.

1. Sissejuhatus

Läänemere regioon on märkimisväärselt atraktiivne Euroopa transpordi võrgustikus tänu regiooni majanduslikule potentsiaalile ja geograafilise asendile. Selleks, et võrgustikul toimivad tarneahelad oleksid paindlikud ja võimelised reageerima muutustele, on vajalik asjakohaseid teadmisi ja oskusi, et juhtimisotsused põhineksid kompleksete mõjude arvestamisele. Otsusreeglitele toetudes on võimalik kasutada mitmekriteeriumilist lähenemist. Kasutades mitmekriteeriumilist otsuse või valiku tegemise lähenemisviisi transpordi ülesande püstitamisel või lahendamisel saab eristada seitset tüüpilist sammu:

- Alternatiivsete veoahelate leidmine;
- Veoahela kriteeriumite määramine;
- Valitud kriteeriumite osatähtsuse hindamine;
- Iga kriteeriumi mõju hindamiseks sobiva skaala kujundamine;
- Iga alternatiivi ja iga kriteeriumi mõju hindamine kokkulepitud skaalal;
- Erinevate kriteeriumite kombinatsioonide koosmõju hindamine;
- Parem alternatiivi valimine.

2 Metoodiline lähenemine (TRELOGIC mudelile)

Mängude teoorial põhinev koolitusmeetod TRELOGIC sisaldab 6-astmelist veoprotsessi kavandamist:

A. Probleemi püstitus, lähteandmete valik. Tarneahela alternatiivide valik;

B. Kaubaveo alternatiivsete marsruutide väljatöötamine. Vajalike lähteandmete otsing.

C. Parima marsruudi valimise kriteeriumite määramine, veo teostatavuse analüüs.

D. Uuringuvõimalused logistika tulemuslikkuse indeksi (LPI) kui interaktiivse võrdlusuuringu töövahendi abil, mis loodud selleks, et aidata logistika ekspertidel tuvastada väljakutseid ja võimalusi, millega nad tarnete logistika valdkonnas kokku puutuvad;

E. Analüütilise hierarhiaprotsessi (AHP) kui mitmekriteeriumilise otsuste langetamise meetodite uuring;

F. AHP meetodi praktiline kasutamine juhtumiuuringus sõnastatud ülesande lahendamisel. Individuaalne ja rühmatöö tarkvararakendused.

3. Õppeprotsessi kirjeldus

3.1. Mängude teoorial põhinev juhtumipõhine õpe. Praktilise ülesande formuleerimine, andmete otsing.

Hiinast pärit üksusrong (plokkrong) konteinerite vedamiseks peaks saabuma Rootsi (Stockholmi sadama konteinerterminaali). Juhtumi analüüsil eeldatakse, et konteinerite lähtepunktiks on Moskva piirkonnas paiknev transiidikeskus. Veo korraldamiseks lähtepunkist

Moskva piirkonna Transiidikeskusest sihtkohta (Stockholmi sadama konteinerterminaal) on valitud kolm alternatiivset marsruuti läbi Läti, Eesti või Soome (Vt joonis 1).

- Moskva – Port Rauma (Soome) – Stockholm
- Moskva - Port Muuga (Eesti) – Stockholm
- Moskva – Port Riga (Läti) – Stockholm

Joonis 1. Alternatiivsed marsruudid

Vedude kavandamisel kasutatakse järgmist teavet ja eeldusi:

- Kõikidel valitud marsruutidel on sama transpordi liigiga veo tariifid ühesugused;
- Kõik teenustasud on kõigis sadamates ühesugused;
- Lähtepunkti, vahepunktide ja sihtpunkti vahekaugused määratakse Google Mapi abil.
- Alternatiivsetel marsruutidel olevate riikide Logistics Perfomance Indeks (LPI) on esitatud Maailmapanga (WB) kodulehel (https://lpi.worldbank.org/about).

3.2 Parima marsruudi valiku kriteeriumite formuleerimine

Selle mudeli võtmetulemusnäitajate taksonoomiat saab kirjeldada viie klastri parameetritega– majandus, geograafia, infrastruktuur, tehnoloogia ja varjatud tegurid. Nii kvantitatiivsete kui ka kvalitatiivsete KPI-de mõõdikud pakutakse välja [4] ja neid kirjeldatakse lisajuhendis. Lisaks saavad üliõpilased KPI-na kasutada logistika tulemuslikkuse indeksit (LPI). Üliõpilased peaksid analüüsima
KPI-d selleks, et hinnata millistel käsitletava juhtumi teguritel on paarisvõrdluses suurem mõju.

3.3 Analüütilis-hirarhilise protsessi (AHP) kui meetodi kasutamine mitmekriteeriumilise otsuse langetamiseks.

Analüütilis-hierarhiline mudel (AHP) on struktureeritud töövahend keeruliste otsuste tegemise korrastamiseks ja analüüsimiseks, mis põhineb matemaatikal ja psühholoogial. See on kõige täpsem lähenemisviis erinevate kriteeriumite kaalu kvalifitseerimiseks. Ekspertide hinnanguid kasutatakse tegurite mõju suhtelise suuruse hindamiseks paarisvõrdluste abil. Iga ekspert hindab spetsiaalses küsimustikus paarisvõrdluste abil tegurite mõjusust . AHP on mitme kriteeriumiga mudel, mis pakub metoodikat alternatiivide võrdlemiseks, struktureerides kriteeriumid hierarhiasse, pakkudes kasutajate poolt hierarhia madalaimal tasemel kriteeriumide võrdlust paarikaupa ja tulemuste sünteesimist arvväärtuseks. Üliõpilased peaksid uurima AHP meetodit ja analüüsima KPI-d, et hinnata millistel vaadeldava juhtumi teguritest on paarisvõrdluses suurem mõju [1-3].

3.3 Analüütilis- hiearhilise meetodi (AHP) kasutamine mitmekriteeriumilise otsuse tegemise protsessis

Analüütiline hierarhiline lähenemine (AHP) on struktureeritud tehnika organiseerimaks kompleksete otsuste tegemise protsessi tuginedes nii matemaatiliste kui ka psühholoogiliste faktorite arvestamist.
Meetod arvestab täpset lähenemisviisi kriteeriumite kaalu hindamisel. Ekspertide kogemusi kasutatakse tegurite suhtelisuse hindamisel paarisvõrdluse kaudu. Iga vastaja peab spetsiaalse küsimustiku abil võrdlema kahe teguri suhtelist olulisust.
AHP on mitmekriteeriumiline mudel, mis annab metoodika alternatiivsete marsruutide omavaheliseks võrdluseks, struktureerides hierarhiliselt eelnevalt valitud mõjutegureid. See mudel võimaldab nende tegurite paarikaupa võrdluse teel sünteesida arvuline kvantitatiivne tulemus.
Üliõpilasel tuleb selgeks õppida AHP meetod ja analüüsida KPId, et hinnata, milline näitaja on paarisvõrdluses suurema mõjuga.

3.4 TRELOGIC-u praktiline kasutamine juhtumiuuringus sõnastatud probleemi lahendamiseks väjatöötatud tarkvaratööriista abil

TRELOGIC-u praktiliseks kasutamiseks on loodud kaheastmeline protseduur:
1. Individuaalne töö. Tarkvara ”TRELOGIC” kasutades üliõpilane võrdleb kõiki alternatiivseid marsruute kõigi kriteeriumite järgi ja annab neile vastavalt juhistele eksperthinnangu.
2. Rühmatöö (näost näkku töötuba või veebiseminar). Üliõpilased arutavad koos teiste mängus osalejatega nende eksperthinnanguid ja erinevuste põhjuseid.

4. Viited

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Norādījumi lietošanai

datorspēļu tehnoloģijas (TRELOGIC) transporta un loģistikas speciālistu padziļinātai apmācībai

1. Ievads

Baltijas reģions ir ievērojams ar savu ekonomiski izdevīgo ģeogrāfisko stāvokli Eirāzijas transporta sistēmā. Esošo piegādes ķēžu pārkonfigurēšana klientiem ir radījusi vajadzību pēc elastīgākas un adaptīvākas sistēmas transporta un loģistikas saišu veidošanai, izmantojot lēmumu atbalsta sistēmu.
Optimāla preču pārvadāšanas maršruta izvēles problēmai ir septiņi tipiski lēmumu pieņemšanas posmi daudzkritēriālai novērtēšanai:

- noteikt transportēšanas alternatīvas;
- noteikt efektivitātes kritērijus;
- noteikt efektivitātes kritēriju relatīvo nozīmi;
- izveidot samērīgu skalu katra kritērija līmeņu mērīšanai;
- izmantojot noteikto skalu, kvantitatīvi noteikt katra kritērija līmeni (ietekmi) katrai alternatīvai darbībai;
- jānosaka dažādu kritēriju kumulatīvā ietekme katrai alternatīvai;
- izvēlēties vispiemērotāko alternatīvu.

2. Metodoloģiskā pieeja

Metodoloģiskā pieeja, ko izmanto TRELOGIC apmācības metodē rotaļas veidā, ietver 6 soļu studiju procesu, izmantojot gadījumu izpēti:

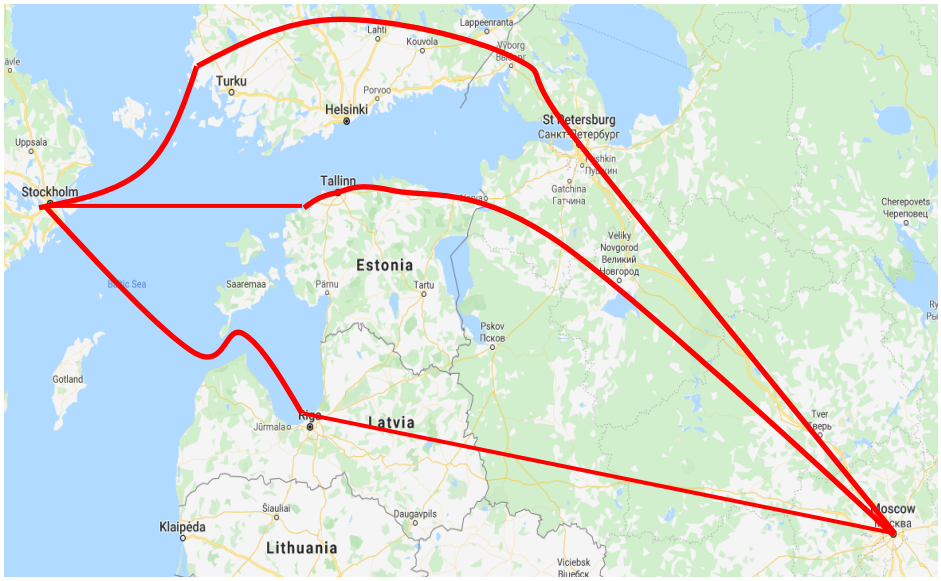
A. Praktiskā uzdevuma formulēšana, datu avotu meklēšana tā risinājumam. Alternatīvo kravu piegādes maršrutu konstruēšana praktiskā pētījuma ietvaros. Nepieciešamo datu meklēšana.
B. Izdevīgākā maršruta izvēles kritēriju formulēšana. Loģistikas veiktspējas indeksa (LPI) iespēju izpēte, kā salīdzināšanas analīzes interaktīvu rīku, kas izstrādāts, lai palīdzētu loģistikas profesionāļiem noteikt problēmas un iespējas, ar kurām viņi saskaras savā darbā tirdzniecības loģistikas sfērā.
C. Analītiskās hierarhijas procesa (AHP) kā daudzkritēriju lēmumu pieņemšanas metodes izpēte.
D. AHP metodes praktiskā izmantošana, lai atrisinātu tematiskajā izpētē izvirzīto uzdevumu, pamatojoties uz izstrādāto programmatūras rīku. Individuāls un grupas ekspertu programmatūras pielietojums.

3. Studiju procesa apraksts

3.1. Spēles praktiskais uzdevums. Praktiskā uzdevuma izklāsts, datu avotu meklēšana tā risinājumam

Konteinervilcienam no Ķīnas jāierodas Zviedrijā (konteineru termināls Stokholmas ostā). Maskavas apgabala termināls un loģistikas centrs ir maršruta tranzīta punkts. Tad ir trīs alternatīvas, kā nokļūt Stokholmā caur Rīgu (Latvija), Muugu (Igaunija) vai Raumu (Somija):

- Maskava - osta Rauma (Somija) - Stokholma
- Maskava - osta Muuga (Igaunija) - Stokholma
- Maskava - osta Rīga (Latvija) - Stokholma



1. attēls. Trīs alternatīvie maršruti

Tiek izmantota šāda informācija un pieņēmumi:

- visi tarifi par pārvadājumiem ar vienu transporta veidu ir vienādi visiem maršrutiem,
- visas pakalpojumu maksas visās ostās ir vienādas,
- attālumi starp sākuma punktu, starppunktiem un piegādes punktu tiek noteikti, izmantojot *Google Map*.
- Pasaules bankas vietnē tiek sniegta informācija par LPI valstīm, caur kurām iet alternatīvi maršruti (https://lpi.worldbank.org/about).

3.2. Vislabākā maršruta izvēles kritēriju formulēšana

Šī modeļa galveno darbības rādītāju (KPI) taksonomiju var raksturot ar parametru kopumu piecās kopās - ekonomika, ģeogrāfija, infrastruktūra, tehnoloģija un papildu faktori. Gan kvantitatīvo, gan kvalitatīvo KPI metrikas ir ierosinātas [4] un aprakstītas papildu instrukcijās. Turklāt studenti kā KPI var izmantot Loģistikas veiktspējas indeksu (LPI). Studentiem vajadzētu analizēt KPI, lai novērtētu, kuri konkrētā gadījuma faktori vairāk ietekmēs pāru salīdzināšanu.

3.3. Analītiskās hierarhijas procesa (AHP) kā daudzkritēriju lēmumu pieņemšanas metodes izpēte

Analītiskās hierarhijas process (AHP) ir strukturēta metode sarežģītu lēmumu organizēšanai un analizēšanai, pamatojoties uz matemātiku un psiholoģiju. Tas ir visprecīzākā pieeja kritēriju svara kvantitatīvai noteikšanai. Atsevišķu ekspertu pieredze tiek izmantota, lai novērtētu faktoru relatīvo lielumu, salīdzinot tos pa pāriem. Katram no respondentiem būtu jāsalīdzina katru pāri speciāli izveidotās anketas rādītāju relatīvā nozīme.
AHP ir daudzkritēriju modelis, kas nodrošina alternatīvu salīdzināšanas metodiku, strukturējot kritērijus hierarhijā, apvienojot kritērijus lietotāja ievadītās hierarhijas zemākajā līmenī un rezultātus sintezējot vienā skaitliskā vērtībā.
Studentiem vajadzētu izpētīt AHP metodi un analizēt KPI, lai novērtētu, kurš no konkrētā gadījuma faktoriem vairāk ietekmēs pāru salīdzināšanu [1-3].

3.4. TreLogic praktiskā izmantošana risinājumā tematiskajā izpētē izvirzītajā uzdevumā, pamatojoties uz izstrādāto programmatūras rīku

TreLogic praktiskā izmantošanas procedūra sastāv no diviem posmiem:

1. *Individuālais darbs.* Izmantojot Trelogic programmatūru, students salīdzina katru alternatīvo maršrutu visos kritērijos un sniedz viņiem ekspertu vērtējumu saskaņā ar instrukcijām.
2. *Grupas darbs* (klātienes seminārs vai vebinārs). Studenti apspriež savus ekspertu viedokļus un domstarpību iemeslus ar citiem spēles dalībniekiem.

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Handledning för användandet av

Spelbaserad E-learningteknologi för träning och utbildning av transport- och logistik specialister (TRELOGIC)

1. Introduktion

Den baltiska regionen utmärker sig för sin ekonomiskt fördelaktiga geografiska position inom det europeisk-asiatiska transportsystemet. Omgruppering av leveranskedjor till kunder har lett till behov av mer flexibla och anpassbara system för transport och logistik samt hjälp av beslutsstödsystem. Beslutsfattandet för transportprocessen innehåller sju typiska steg av multikriterier:

- identifiera transportatalternativ
- etablera prestationskriterier
- etablera relative vikt av prestationskriterier
- etablera en mätbar skala för nivåer av varje kriterie
- använda skalan och kvantifiera nivån (effekten) av varje kriterie för varje alternativ
- etablera den kombinerade effekten av de olika kriterierna för varje alternativ
- bestämma det mest tillfredsställande alternativet

2. Metodologisk approach

Den metodologiska approachen som används i den spelbaserade träningsmetoden TRELOGIC innehåller en 6-stegs lärprocess för varje studie:

A. Formulering av ett praktiskt problem, för att finna datakällan till dess lösning. Formulering av alternativa rutter för godsleverans inom ramen för fallstudien. Sökande efter nödvändig data.
B. Formulering av kriterier för val av bästa rutten. Studerande av möjligheter för logistiskt prestationsindex (LPI) som ett interaktivt benchmarkingverktyg framtaget för att hjälpa logistiker att identifiera utmaningar och möjligheter som de möter i utövandet av affärsmässig losgistik.
C. Studerande av den analytiska hierarkiska processen (AHP) som en metod för beslutsfattande med multikriterier.
D. Praktisk användning av AHP för att lösa problemet som formulerats i fallstudien, baserat på det framtagna mjukvaruverktyget. Användning av mjukvaran individuellt och i grupp.

3. Beskrivning av lärprocessen

3.1. Spelbaserad fallstudie. Formulering av ett praktiskt problem, för att finna datakällan till dess lösning

Ett containertåg från Kina skulle anlända i Sverige (Containerterminalen i Stockholms hamn). Terminal-logistic centre i Moskvaregionen är transitpunkt för rutten. Sedan finns tre alternativ att nå Stockholm via antingen Riga (Lettland), Muuga (Estland) eller Rauma (Finland):

- Moskva hamn Rauma (Finland) -Stockholm
- Moskva hamn Muuga (Estonia) -Stockholm
- Moskva hamn Riga (Latvia) –Stockholm

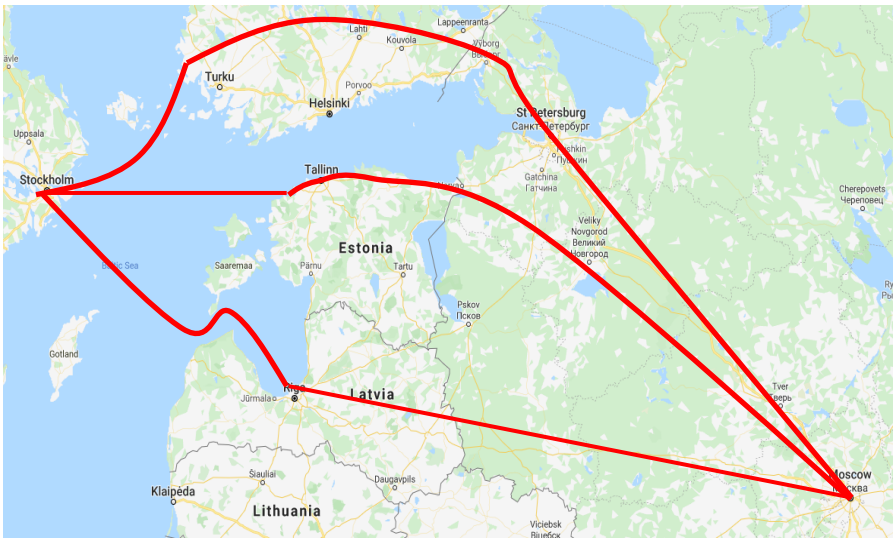

Fig.1. Tre alternativa rutter

Följande information och antaganden används:

- Alla transportavgifter för ett transportslag är samma för alla rutter
- Alla hamnar har samma serviceavgifter
- Avstånden mellan avgångspunkt, mellanpunkt och leveranspunkt bestämns med hjälp av Google Map
- Information om ländernas LPI presenteras på World Banks hemsida (https://lpi.worldbank.org/about) .

3.2. Formulering av kriterier för val av bästa rutten

Taxonomin för den här modellens KPI kan beskrivas med hjälp av parametrar indelade i fem kluster - Ekonomi, Geografi, Infrastruktur, Teknologi och underliggande faktorer. Mått för bade kvanititativa och kvalitativa KPI föreslås i [4] och beskrivs en tilläggsinstruktion. Studenterna kan även använda LPI som KPI. Eleverna ska analysera KPI för att utvärdera vilka faktorer som i detta fall mest har störst inflytande i en parvis jämförelse.

3.3. Studerande av den analytiska hierarkiska processen (AHP) som en metod för beslutsfattande med multikriterier

AHP är en strukturerad teknik för att organisera och analysera komplexa beslut baserat på matematik och psykologi. Det är den mest exakta metoden för att kvantifiera vikten av kriterier. Individuella experters erfarenheter används för att uppskatta de relativa magnituderna av faktorer genom parvisa jämförelser. Varje respondent jämför den relativa vikten mellan de två alternativen med hjälp av en specialdesignad enkät. AHP är en multi-criteria modell som genererar en metodologi för att jämföra alternativ genom att hierarkiskt strukturera kriterier och möjliggöra parvisa jämförelser av kriterier. Den lägsta hierarkiska nivån anges av användaren och modellen syntetiserar resultaten till ett enda numeriskt värde. Studenterna studerar AHP-

metoden och analyserar KPI för att utvärdera vilka faktorer som i detta fall mest har störst inflytande i en parvis jämförelse [1-3].

3.4. Praktisk användning av TreLogic för att lösa problemet som formulerats i fallstudien, baserat på det framtagna mjukvaruverktyget

Den praktiska användningen av TreLogic innehåller en tvåstegsprocedur.
1. Individuellt arbete. Genom att använda mjukvaran TreLogic jämför studenterna varje alternativ rutt för samtliga kriterier och ger dem en expertbedömning enligt instruktionerna.
2. Grupparbete (face-to-face workshop eller webinar). Studenterna diskuterar sina expertbedömningar och orsaker till deras skillnader med andra speldeltagare.

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E-Learning Game-Based Technology for Training and Education of Transport and Logistics Specialists

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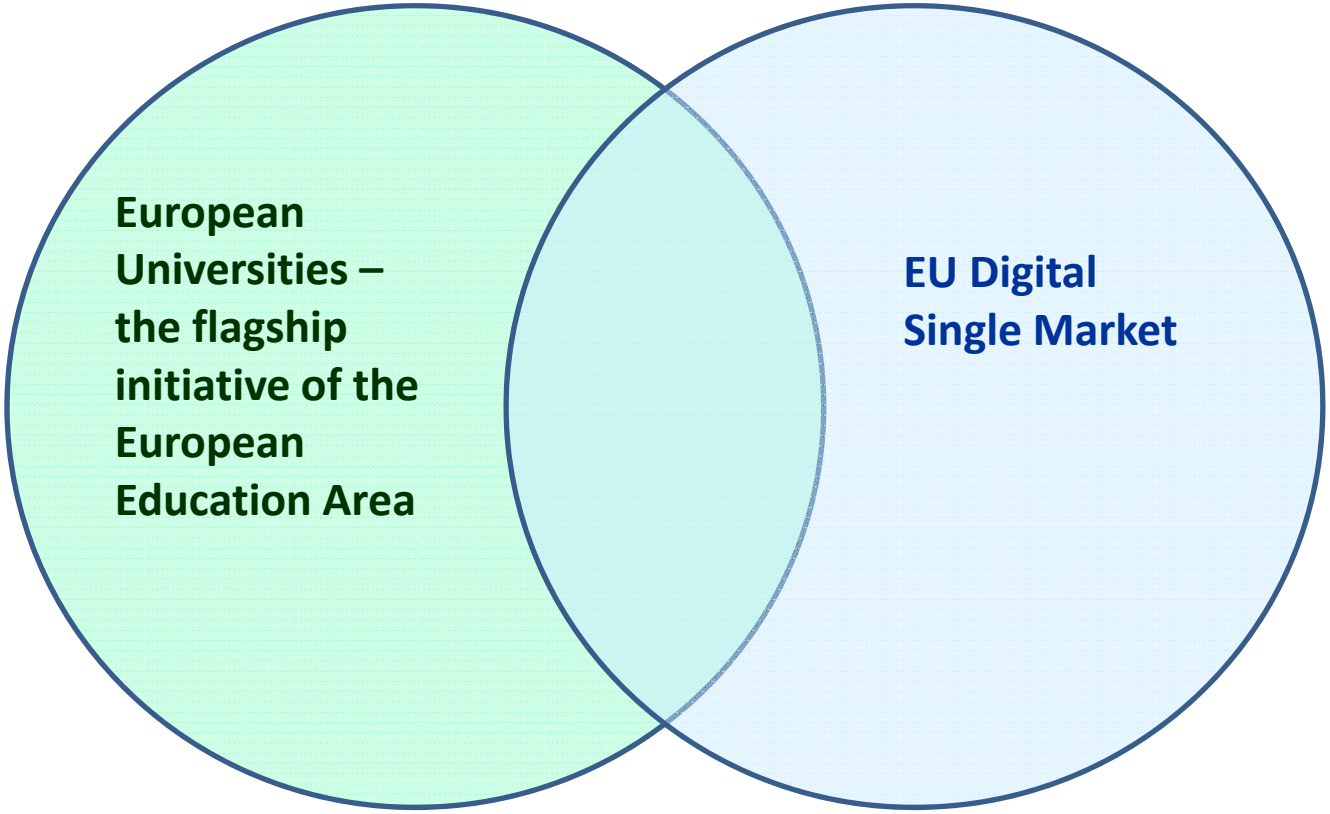

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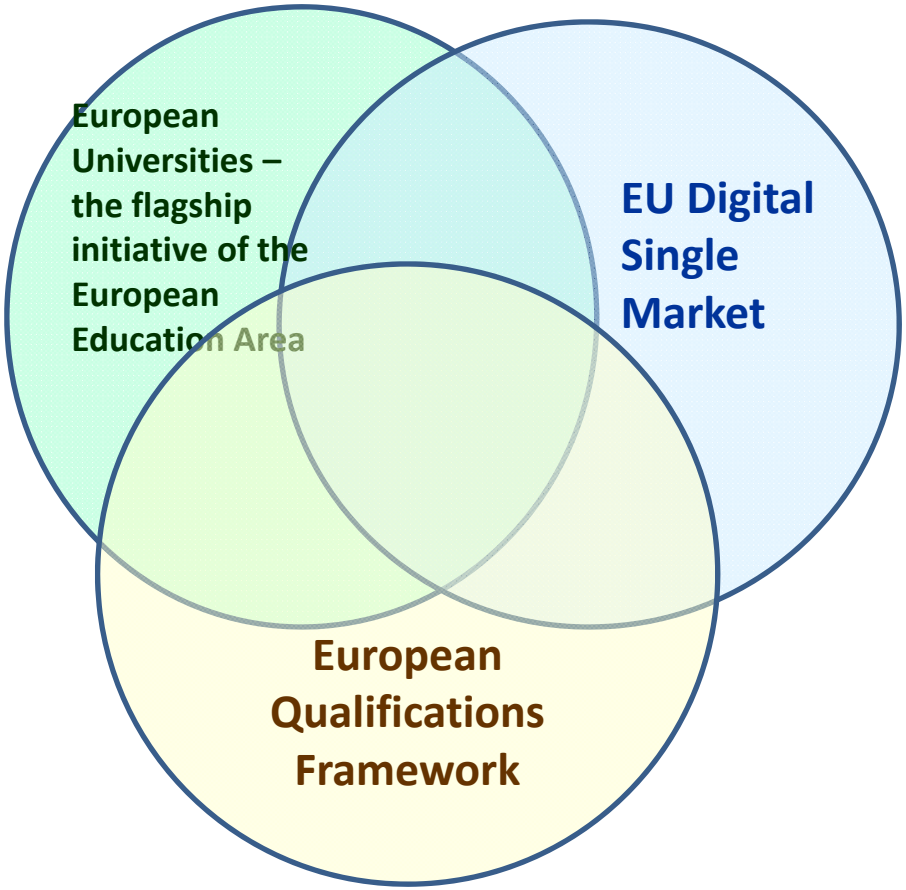

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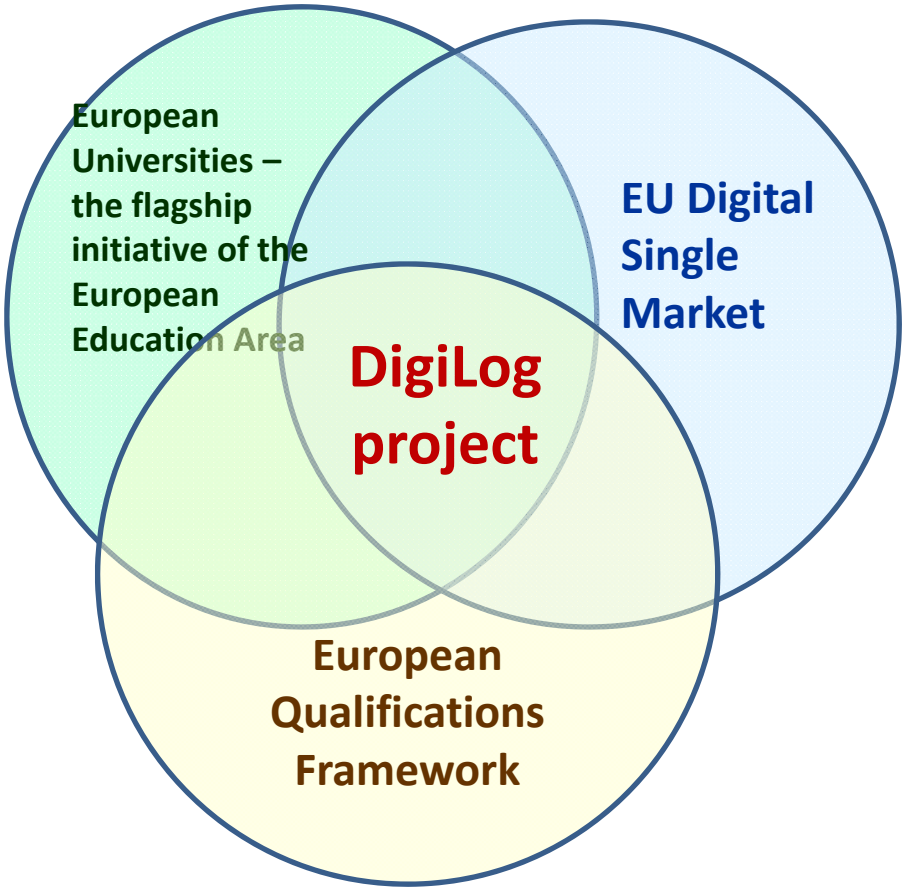

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Digitally supported and virtual study practices for modern logistic systems

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The Project runs for **36 months** starting on **01.09.2018** and finishing on **31.08.2021**

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Partners

TTK, University of Applied Sciences, Estonia

HÄME, University of Applied Sciences, Finland

Transport and Telecommunication Insitute, Latvia

VTI, Swedish National Road and Transport Research Institute

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Output O1:

Virtual and open cross-study curricula for digital environment of Transport and Logistics systems.

Developing the concept and piloting use of simulators for digitally supported T&L systems as virtual training and demonstration platform for innovative solutions.

Output O2:

E-learning game-based Technology for training and education of transport and logistics specialists (TreLogic)

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Output O1

Development of methodological approach of **e-tivities** for T&L education based on **Carpe Diem** learning design process or using other similar tools

E-tivity means "task online"; it is a framework to learn something in a dynamic and interactive way. This activity is based on intense interaction and reflective dialogue between a number of participants, such as learners / students and teachers, who work in a computer-mediated environment.

The idea behind **Carpe Diem** is that every moment of the time during the study process is spent on designing something that can be put into immediate use with learners.

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Output O1: Virtual and open cross-study curricula for digital environment of transport and logistics systems based on Carpe Diem learning design process

Following study subjects were selected by partners:

1. Supply chain management simulation (TTK, 3 credits).
2. Effective warehouse design and process simulation (TTK, 3 credits).
3. Professional Competence of Transport Managers (TTI, 3 credits).
4. Game based multi-criteria decision making for T&L competence development (TTI, 3 credits).
5. Passenger traffic railway markets are opening to competition (HAMK, 3 credits).
6. Train driving exercise for train dispatchers (VTI, 4 credits).

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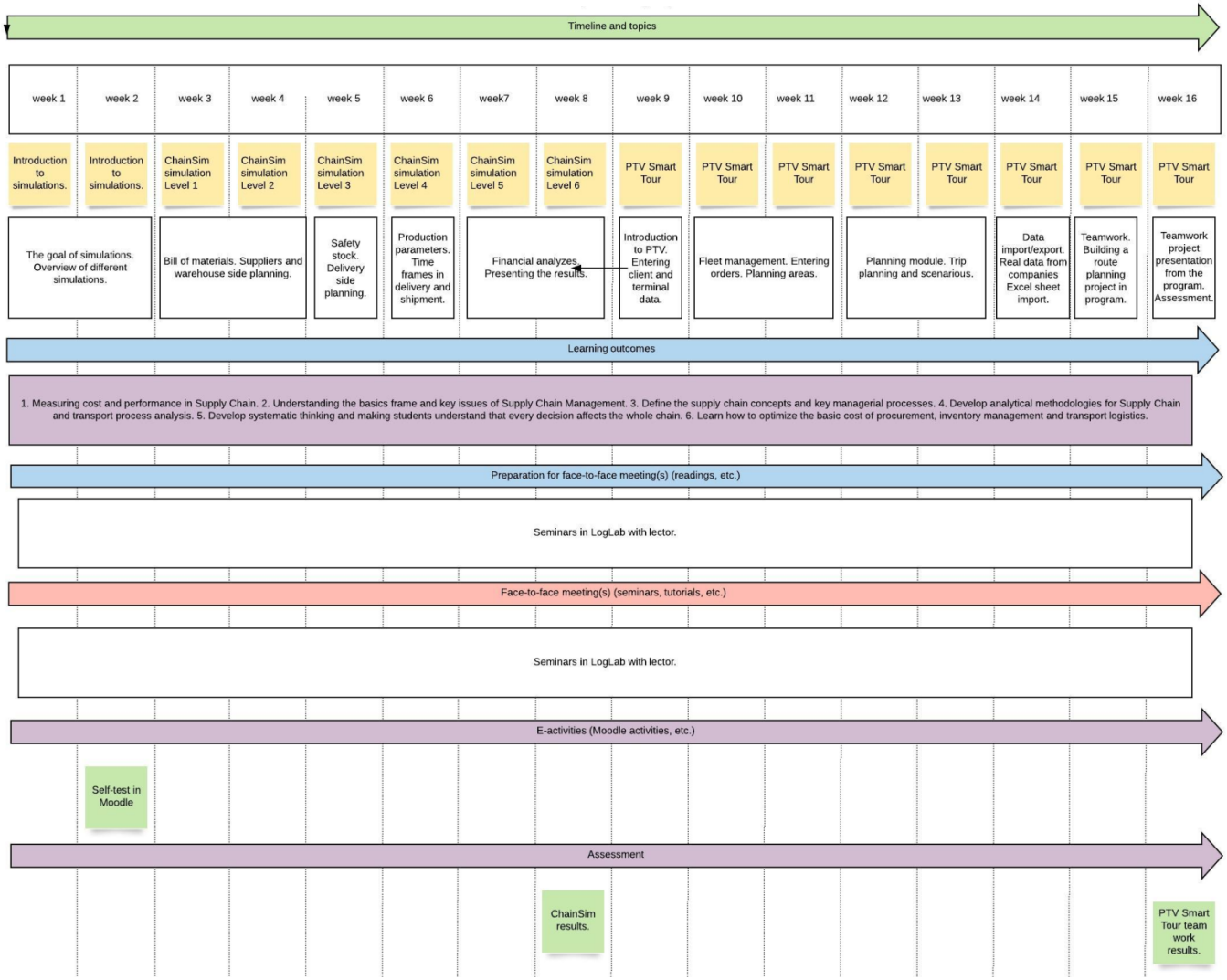
Storyboard



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Main idea of TRELOGIC and methodology of application

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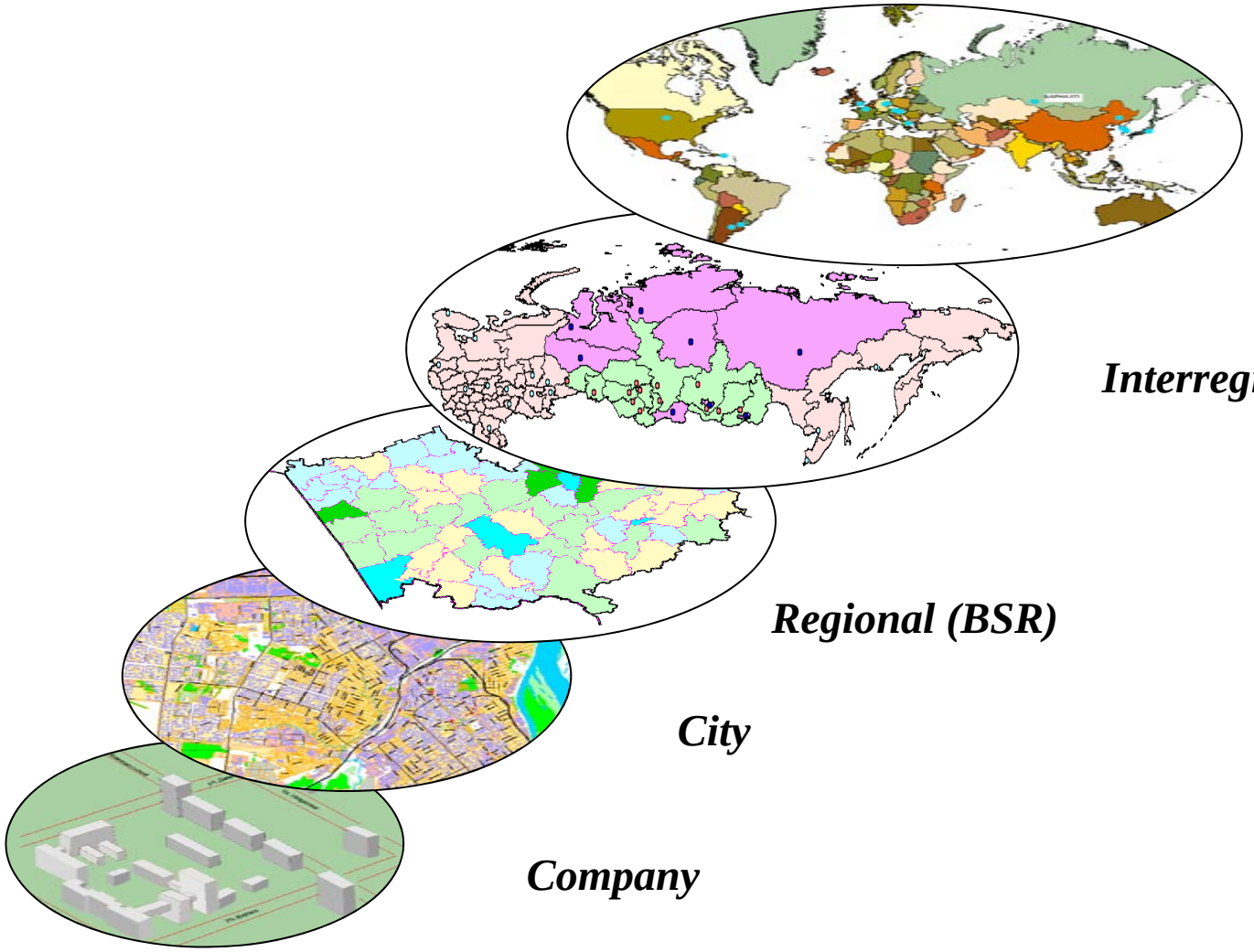
Levels of Logistics and Supply Chain Management



International

Interregional (EU)

Regional (BSR)

City

Company

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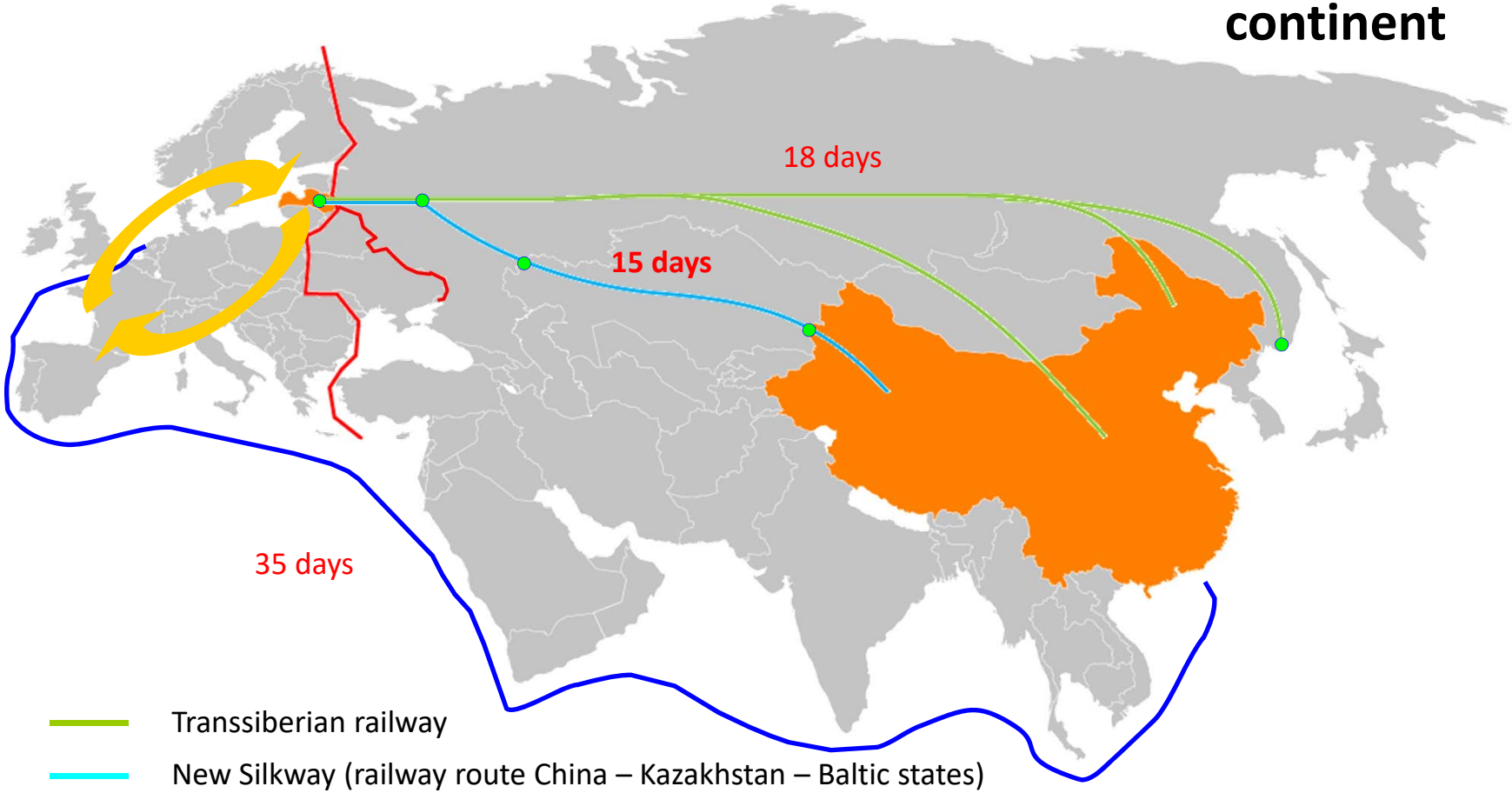
Main transit routes in Euro – Asia continent



- Transsiberian railway
- New Silkway (railway route China – Kazakhstan – Baltic states)
- Ocean route
- EU external border, BY and UA borders

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Main transport routes between EU and Russia

Source: Transport connections between EU and Russia. Ministry of Transport and Communications Finland

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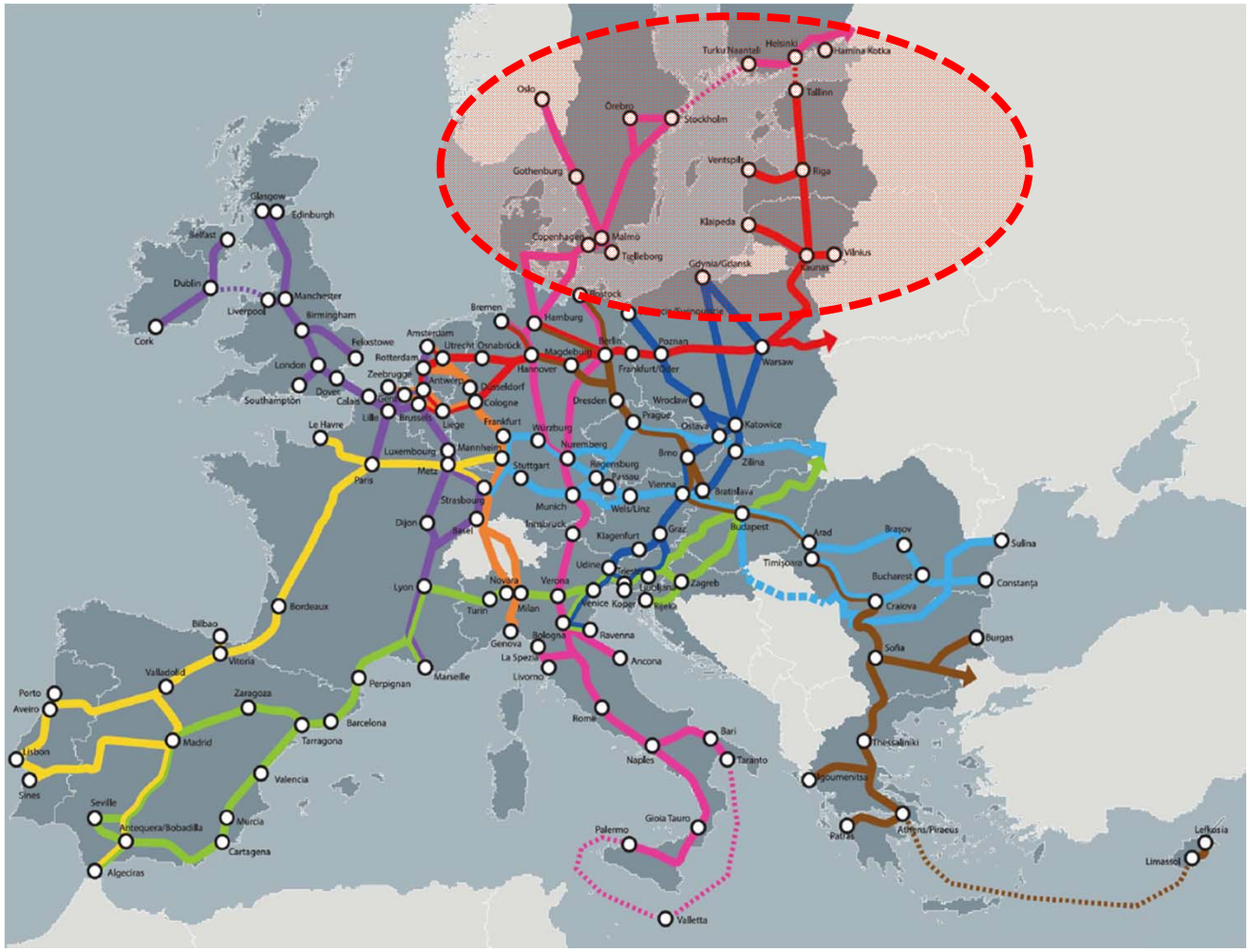
Trans-European Transport Networks (TEN-T)



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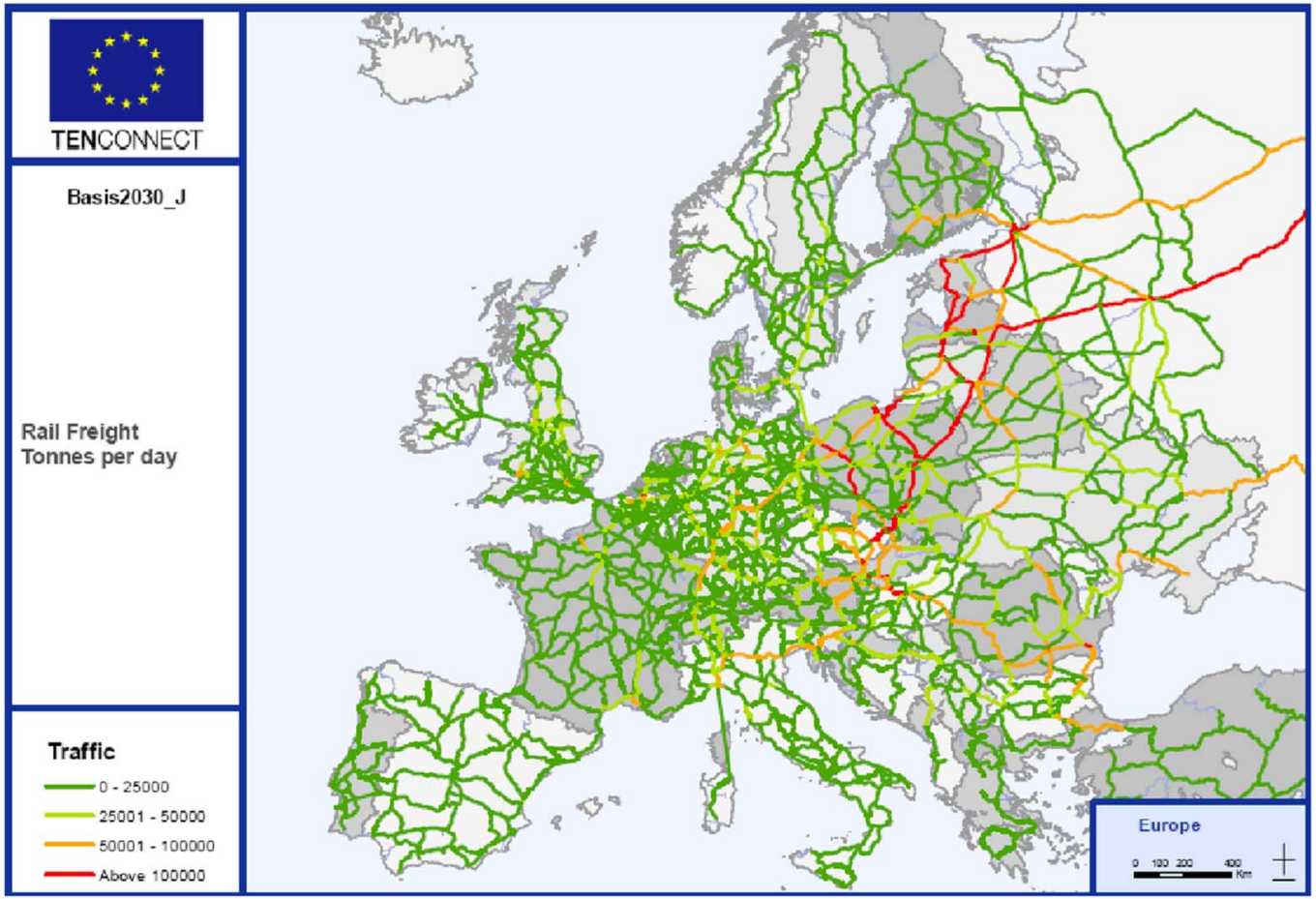
Forecast of rail freight traffic



Traffic loads in tonnes on the Baseline 2030 rail network.

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Case Study. Baltic Sea Region

Map: Spatio Oy

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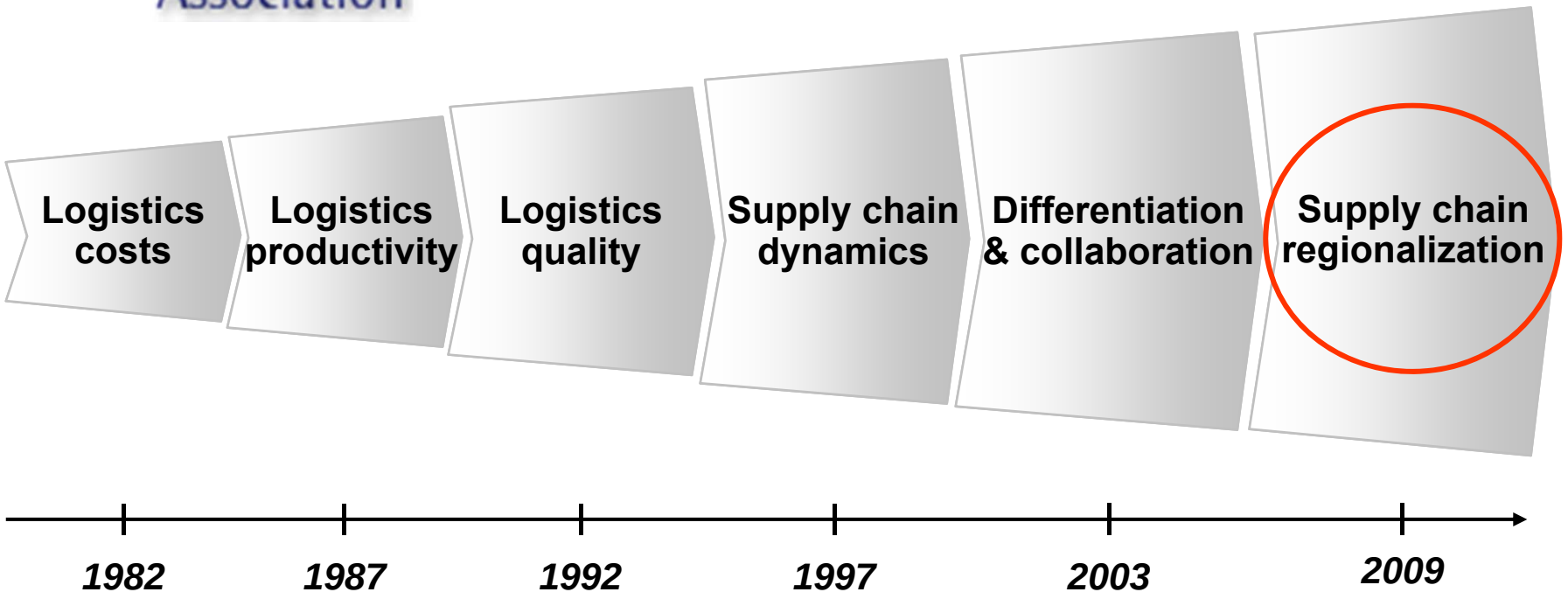
European Logistics Association



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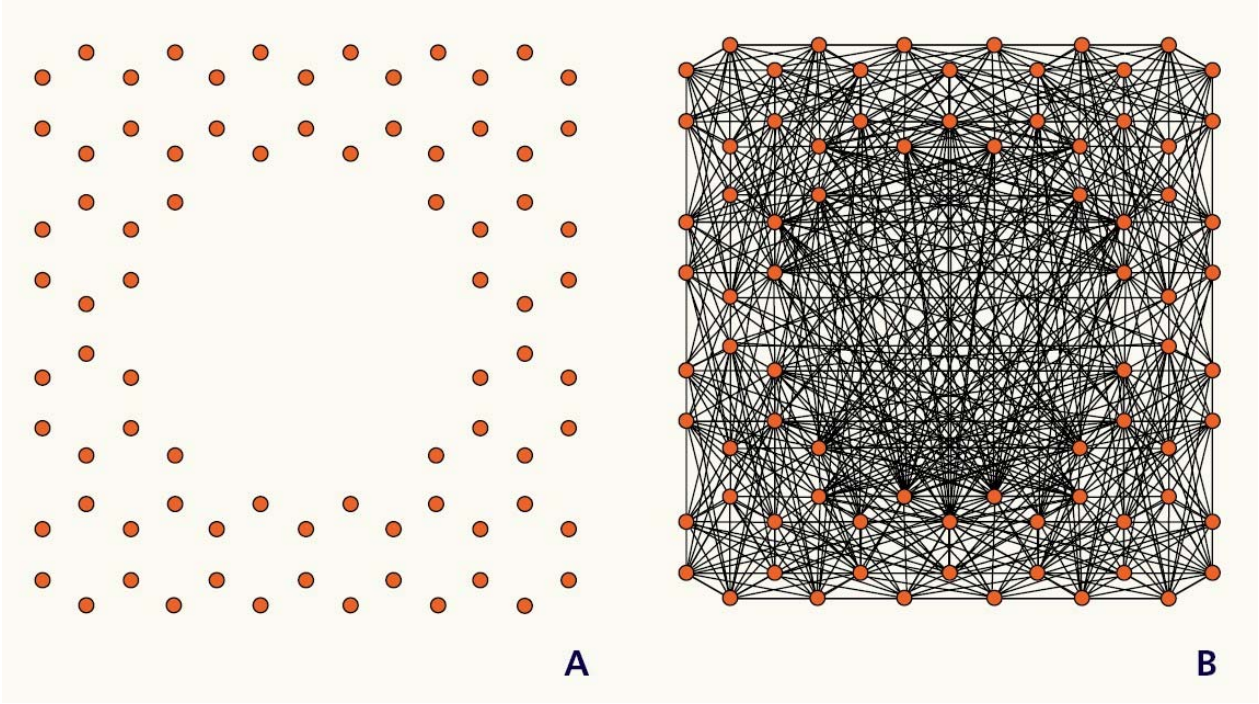
Case Study. Baltic Sea Region

If all **80** points around the Baltic are to be connected with each other. It would require **3160** routes.



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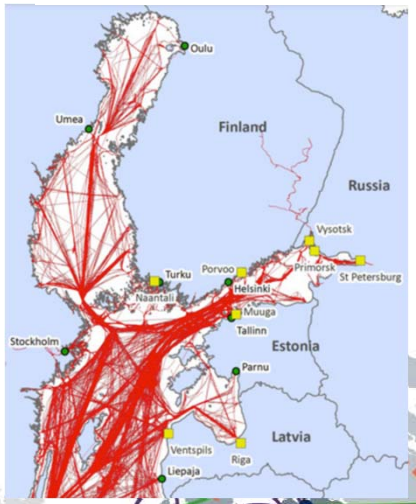
Alternatives in transportation



Some types of functionality:

- Identification of cargo transportation alternatives in the large and regional scale transportation transit system
- The choice of a multimodal transport route
- The optimal routing

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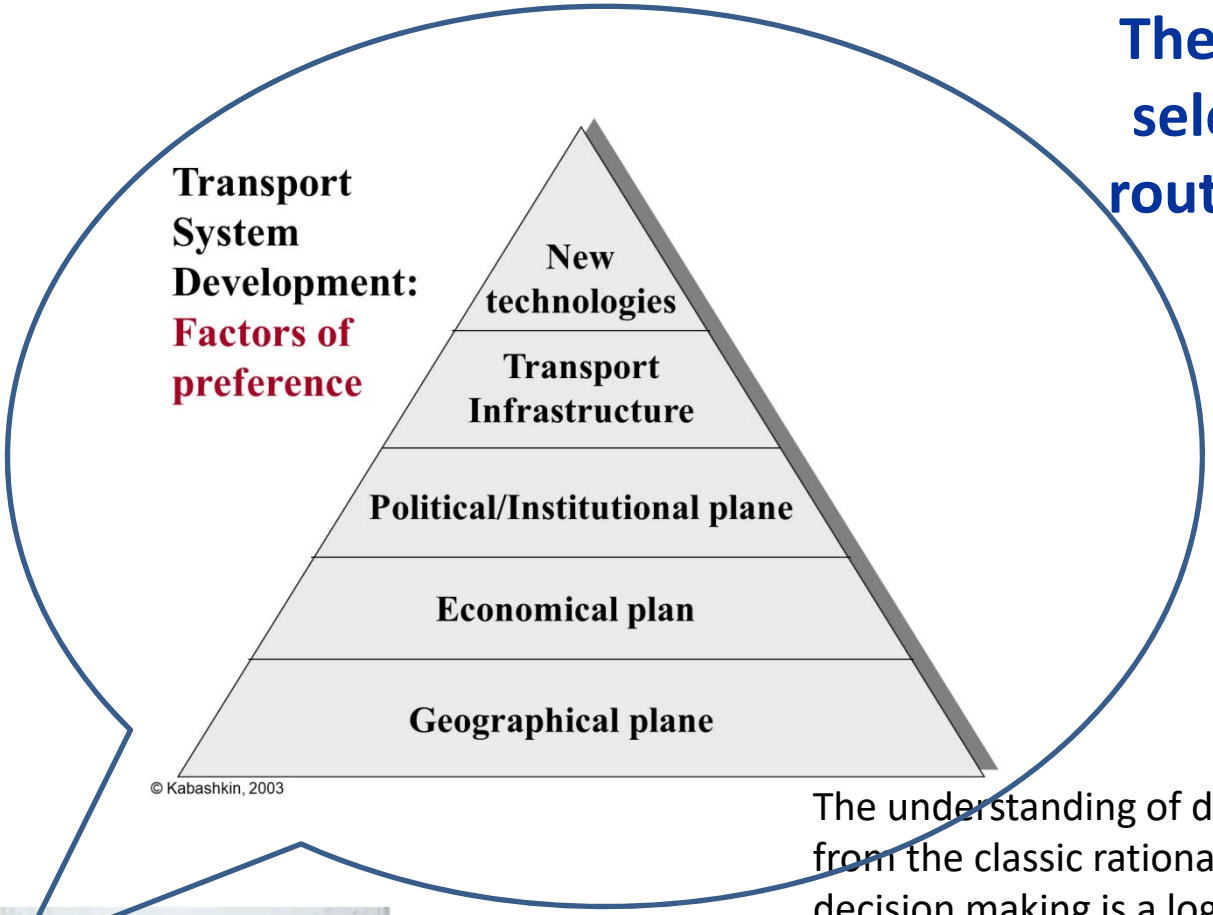
The decision making on selection of alternative route for the delivery of goods



The understanding of decision making has moved far from the classic rational model—which assumed that decision making is a logical process—to encompass the impact of numerous factors. These include the involvement of emotions, energy, physical state, environment, cognitive biases and more.

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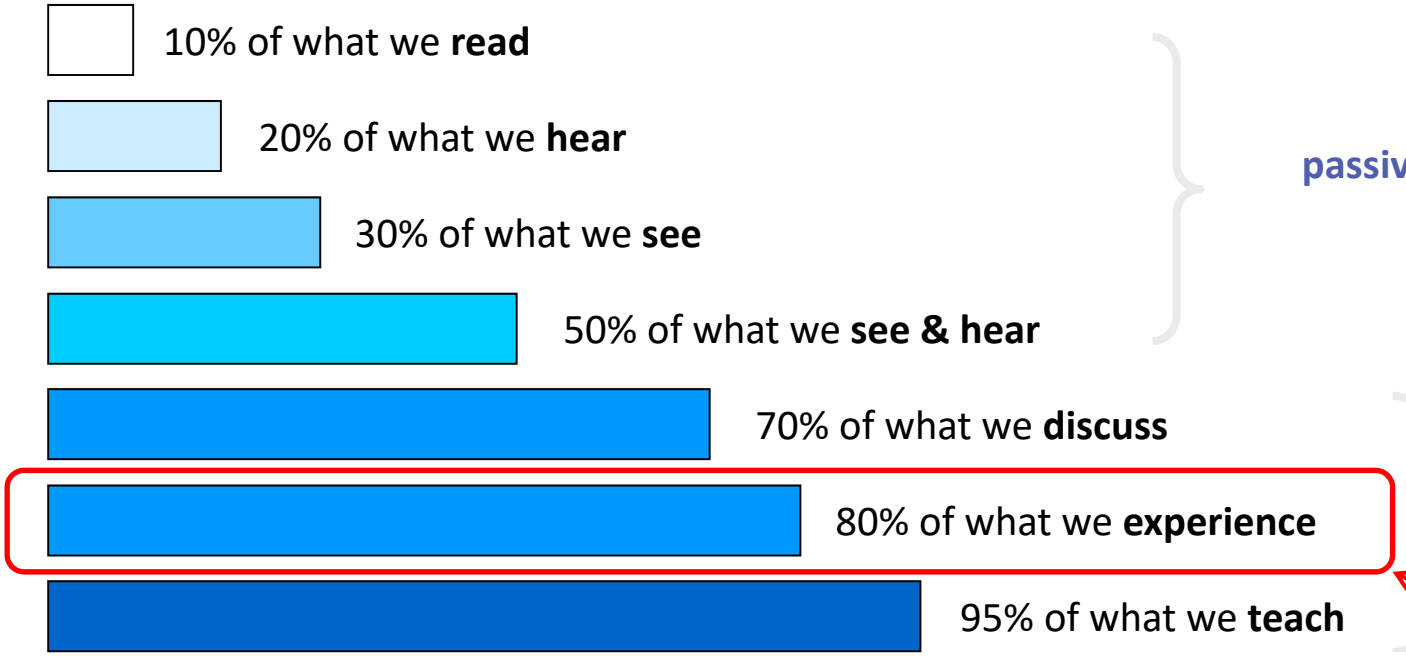
Learning and memory



GAME BASED
TRAINING

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DigiLog/TRELOGIC

is tool for

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Approach problems, situation technique

Proposed functions, constraint system

Proposed design, choice of solution

Build prototypes, test fabrication

GAME BASED TRAINING

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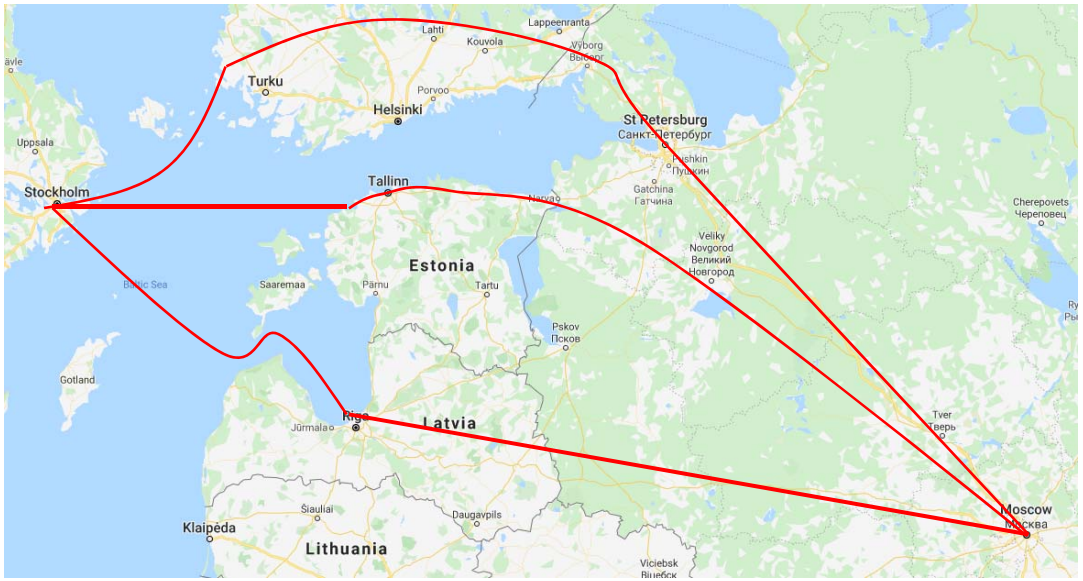
Main steps of learning process

CASE STUDY

1. Game based case study. Selection of alternative route for the delivery of goods within the frame of case study. Search of the necessary data.

There are three alternative routes:

- Moscow-port Rauma (Finland) -Stockholm
- Moscow-port Muuga (Estonia) -Stockholm
- Moscow-port Riga (Latvia) -Stockholm



Practical problem:

A container block train from China should arrive in Sweden (Stockholm port) for further transportation of goods by sea. Terminal-logistic centre of the Moscow region is the first transit point of the route. Then there are three alternatives to achieve Stockholm through Riga (Latvia), Muuga (Estonia) or Rauma (Finland).

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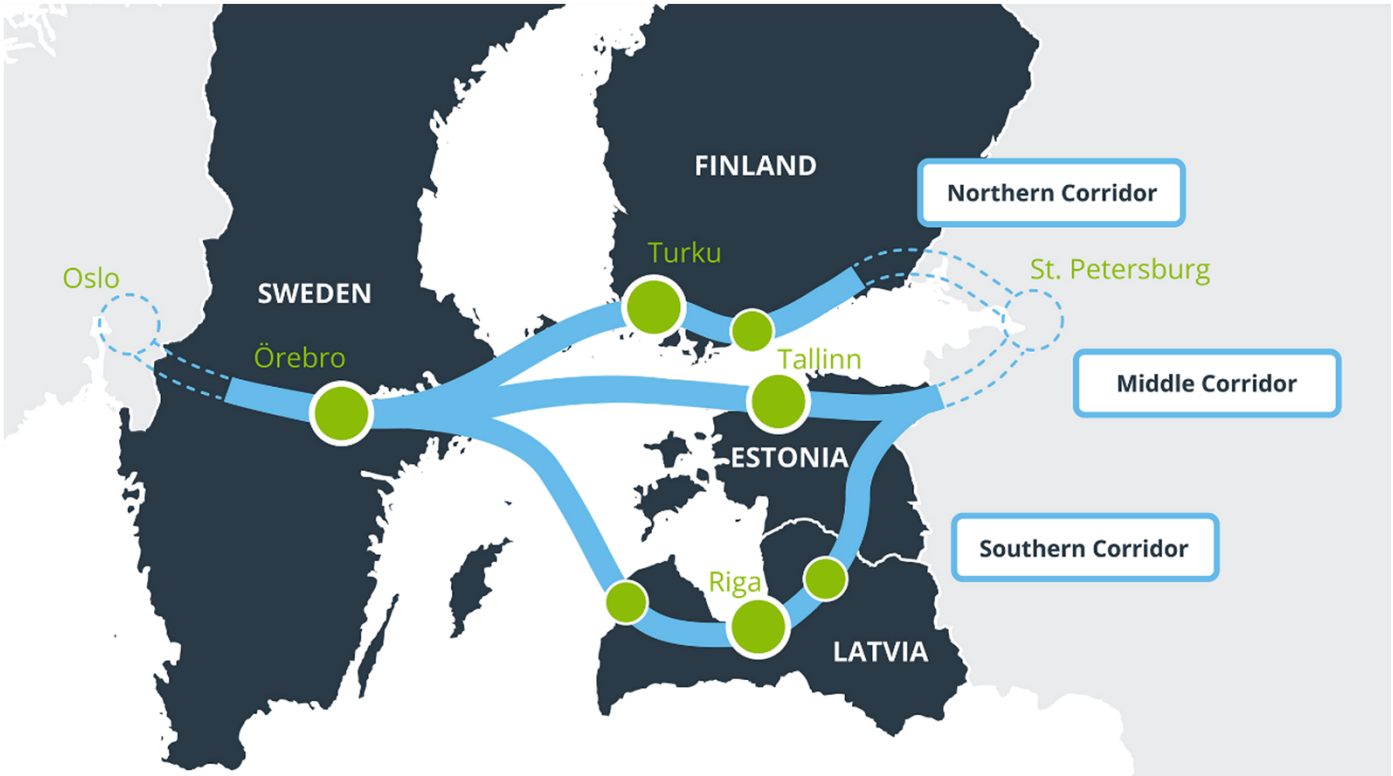
Baltic Loop project (https://www.balticloop.eu/index.php/about/)



Baltic Loop is a Project under the Interreg Central Baltic Programme running from April 2019 until June 2021.

Baltic Loop

Interreg Central Baltic

EUROPEAN UNION
European Regional Development Fund

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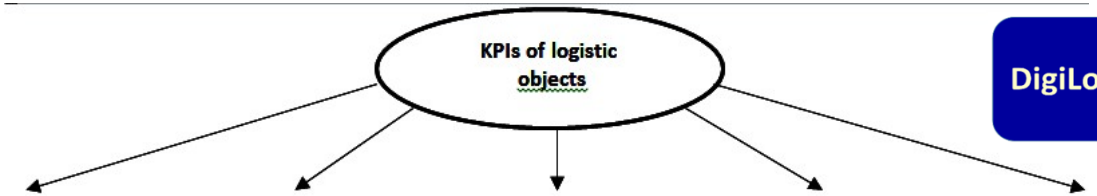
2. Formulation of criteria for choosing the best route.

Taxonomy of key perfomance indicators (KPI) for this model can be described by set of parameters shown at the figure with suggested quantitative metrics for both - quantitative and qualitative KPIs.



Economics	Geography	Infrastructure	Technology	Ulterior factors
Direct transportation costs for 40'DC container, US dollars	Quantity of custom/border points on the route	Capacity of ports and/or border points (congestions as the result) (100%- good, 0% - bad, expert evaluation)	Availability of necessary equipment on the route (% in cases which available, expert evaluation)	Existing cargo flows (100% - much, 0% no any, expert evaluation)
Fluctuations of costs during the year, average in %	Presence of regular shipping Lines/railway services/trucks in the loading area (points 1-100%, expert evaluation)	Quantity of transhipments on the route	Availability of necessary transport on the route (% in cases which available, expert evaluation)	People competences and quality of logistics services in transhipment countries on the route (100% - good, 0% - bad)
Estimated time of transportation, days	Transportation distance of post-carriage in sum (~km in average)*	Quality of transport-related infrastructure (100% - good,0% - bad)	Ability to track and trace on the route (100% - good, 0% no any, expert evaluation)	Quantity of used languages in the country/city of transhipment (average), expert evaluation
Possibilities for custom clearance (quantity of different possibilities)	Possibility to change transportation route in the cluster group (quantity of ports/border cross points etc), transportation mode (quantity)	Availability of bonded warehouses on the route (100% - a lot, 0% - no any)	Electronic invoices and customs procedure (100% - good, 0% - bad, expert evaluation)	Additional added value services on the route (100% - much, 0% - no any, expert evaluation)
Transportation risks (risk of delay, theft, damages), probability (expert evaluation)	Quantity of transit countries on the route	Availability of good railway services on the route (100% - big availability, 0% - small)	Terminal operations efficiency (100% - good, 0% - bad, expert evaluation)	"Longstanding trading spirit" of ports of transhipment (route) (100% - much, 0% - no any, expert evaluation)

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Ports of Stockholm

https://www.portsofstockholm.com/about-us/company-facts/ports--routes/

Stockholm | Nynäshamn | Kapellskär | Vessel calls | About us | Contact

About us

- News
- Company facts
  - Organisation & Ownership
  - Key ratios & Annual report
  - Business Policy & Business Management System
  - Development project Stockholm Norvik Port
  - EU projects & collaborations
  - Ports & routes
  - Processing of personal data - GDPR
- Prices for services/tariffs

Ports & routes

With ports in Stockholm, Kapellskär and Nynäshamn, Ports of Stockholm is strategically located in the heart of Sweden's largest and fastest growing population and consumer region, the Stockholm-Mälar Valley.

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Prices and terms 2020

Port of Stockholm

Version 2020-01-01

CONTENTS

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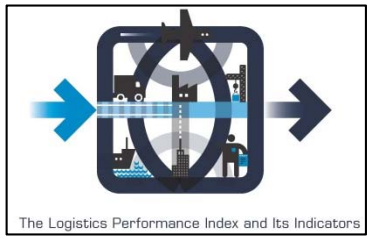


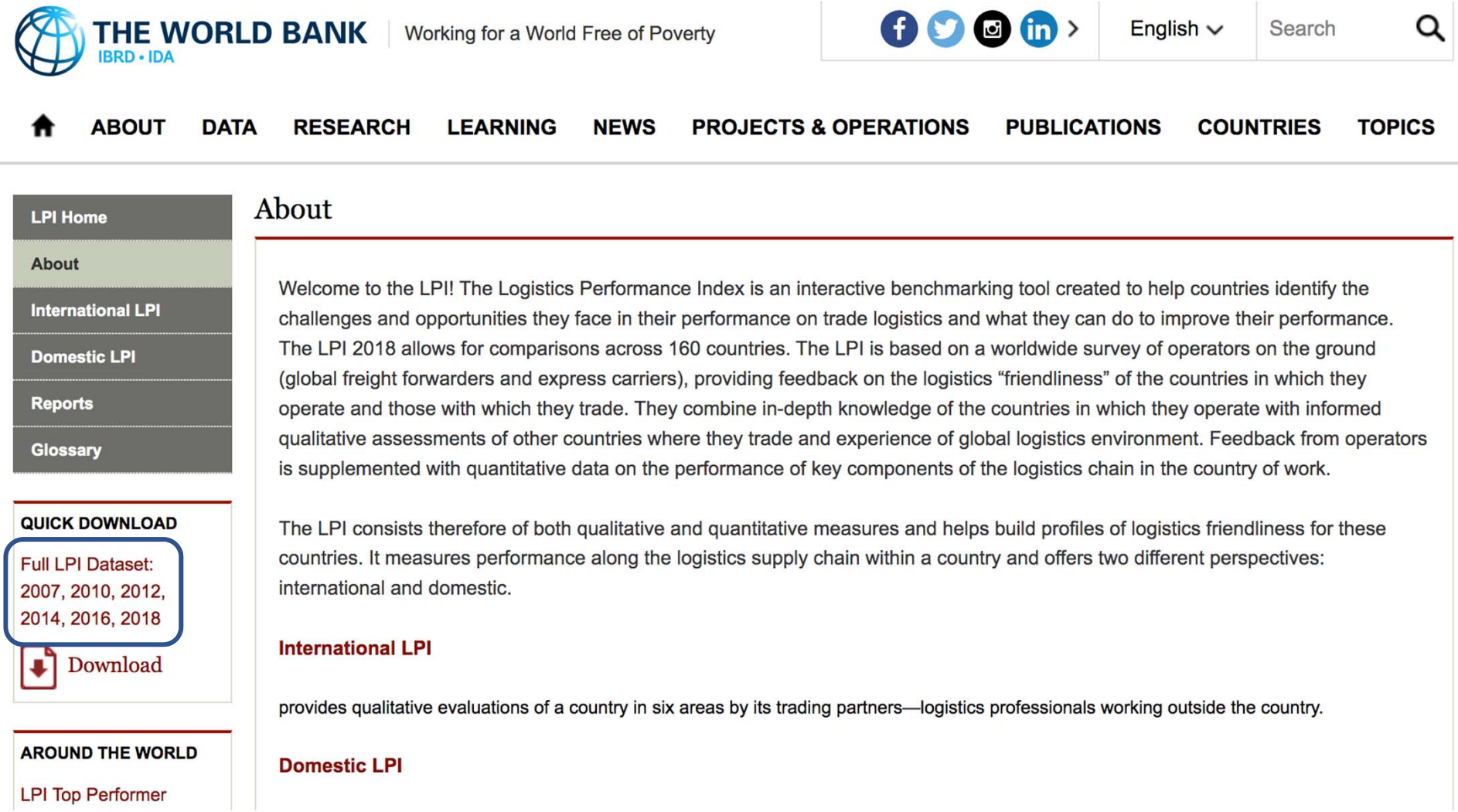
3. Study opportunities of the Logistics Performance Index (LPI) as an interactive benchmarking tool created to help professionals in logistics identify the challenges and opportunities they face in their performance on trade logistics.

Students should study the LPI methodology at a preliminary stage.

The LPI allows for comparisons across 160 countries. The LPI is based on a worldwide survey and consists of both qualitative and quantitative measures and helps build profiles of logistics friendliness for countries. It measures performance along the logistics supply chain within a country and offers two different perspectives: international and domestic.
International LPI provides qualitative evaluations of a country in six areas by its trading partners—logistics professionals working outside the country.
Domestic LPI provides both qualitative and quantitative assessments of a country by logistics professionals working inside it. It includes detailed information on the logistics environment, core logistics processes, institutions, and performance time and cost data.

Logistics Performance Index (LPI)

https://lpi.worldbank.org/about



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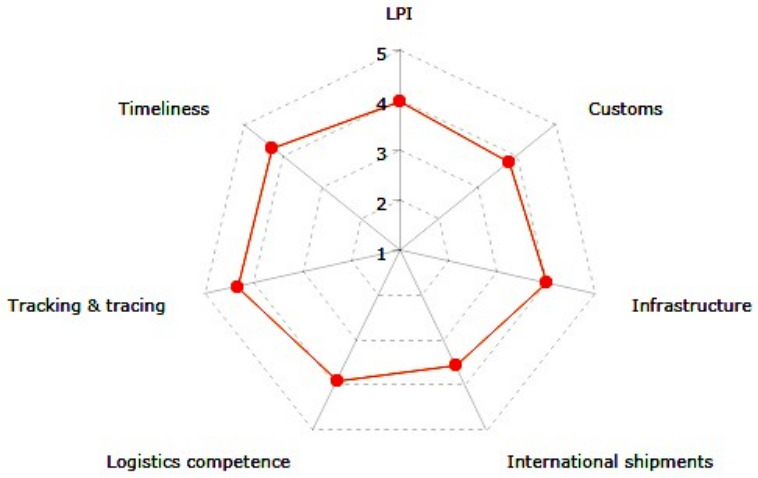
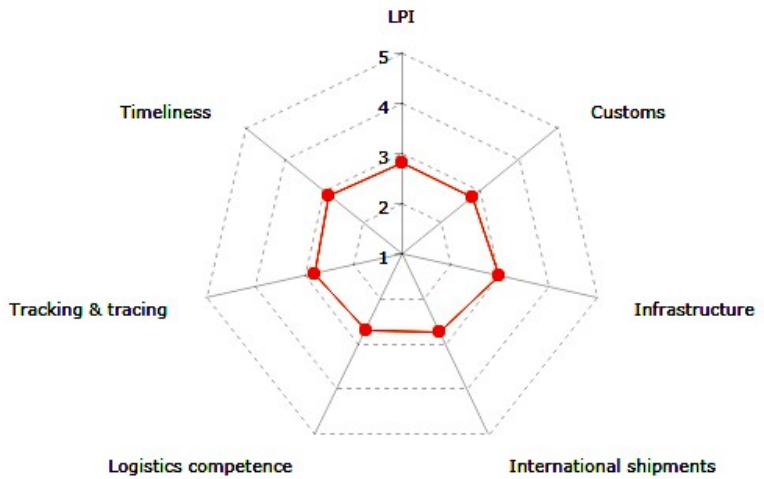
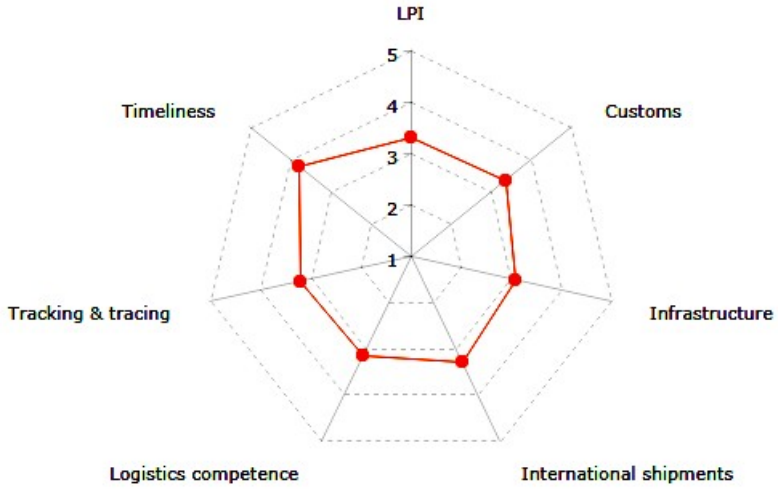
Finland 2018



Latvia 2018



Estonia 2018



Students use information about LPI from the World Bank website (https://lpi.worldbank.org/about) to determine the necessary data for countries through which alternative routes run.

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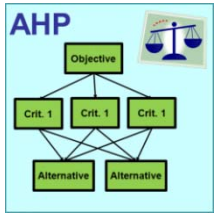
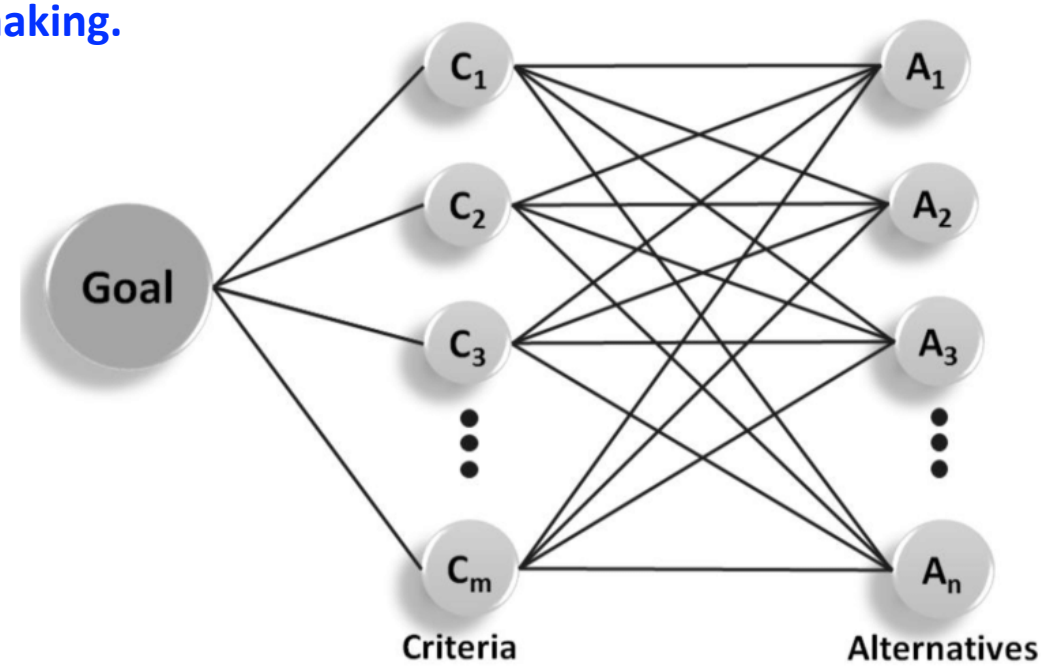


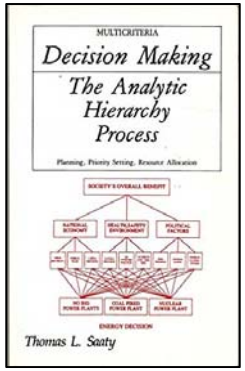
4. Use the Analytic Hierarchy Process (AHP) as method for multicriteria decision making.

AHP is a multicriteria model (proposed by Thomas Saaty) that provides a methodology for comparing alternatives by structuring criteria into a hierarchy, providing for pair-wise comparisons of criteria.



Ranking of Criteria and Alternatives:

- Pairwise comparisons are made by experts with the grades ranging
- Students play the role of experts in the game
- These pairwise comparisons are carried out for all factors to be considered, and the special evaluation matrix is completed.



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Conclusions

The main intellectual outputs of the DIGILOG project:

- Virtual and open cross-study curricula for digital environment of transport and logistics systems based on Carpe Diem learning design process;
- E-learning game-based technology for training and education of transport and logistics specialists;
- Video exercises for study of train traffic and safety management issues using simulation tools.

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