



**Innovation-driven Collaborative European  
Inland Waterways Transport Network**

## **T5.2 – Case Study – Teaching Note**

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## 1 Background & Content

This teaching note provides the framework of the case study and serves as a kind of "guide" for those who want to use the case. The case study is a discussion and design case that requires students to develop their own solution on a real-life base scenario of inland waterway logistics. The case examines the development of eco-friendly transportation strategies, with a focus on inland waterways as a sustainable and efficient mode of transport. It is drawn around a shipping company who plans to shift transport volumes from road to eco-friendly modes of transports when it comes to transports between Austria and Romania. Therefore, related shipment data will be provided by the shipping company and the goal is to analyze the given transport-data to shift from road to inland waterways. The focus lays on a cost-comparison calculation as well as an emissions-calculation based on the GLEC-Framework. The calculation is guided by a step-by-step guidance.

The case is recommended for master students, bachelor students, vocational students and practitioners training. Experience and basic knowledge in the field of logistics is required. There are two case-study versions: a light version for bachelor students, vocational students and practitioners training and an extensive version for master students. The dataset contains data on 100 shipments, but this can be reduced depending on the difficulty (e.g. limitation to 50 shipments for bachelor students).

## 2 Learning Aims

### Light version

After the course, the students

- .... know advantages/disadvantages, applicability and transport lead times of transport modes (road/inland waterway) using intermodal equipment
- ....have a deeper understanding of the characteristics of inland waterway transportation on the Danube regarding
  - vessel types
  - ports with multimodal handling possibilities
  - advantages and disadvantages of IWT (e.g. transport lead time, reliability...)
- ....will get familiar with the cost-calculation of transports on the road compared to inland waterways based on the calculation of first- and last mile costs, shipping costs on the road and the Danube as well as handling costs at ports
- ...know how to calculate transport emissions based on the GLEC-Framework regarding road and inland waterway transportation

### Extended version

In the extended version of the case study the students additionally take a look into the future and learn...

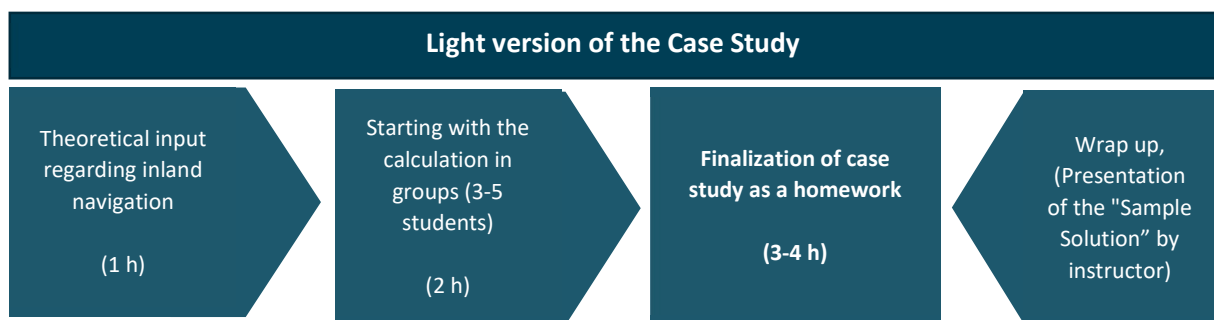
- ....about ongoing projects and efforts regarding multimodality in the Danube Region as well as future trends in inland navigation
- ...about the current feasibility of container transportation on the Danube, future developments
- ... strengths, weaknesses, opportunities and threats of container transportation on the Danube

### 3 Structure and Course Integration

In order to be able to use the case study in as many areas of teaching as possible, there will be a light version (2 hours in class, 4 hours homework) and an extended version (9 hours in class). The following structures and course integrations are suggestions, of course other formats are possible.

#### Light version (2-3 hours in class, 3-4 hours preparation as a homework)

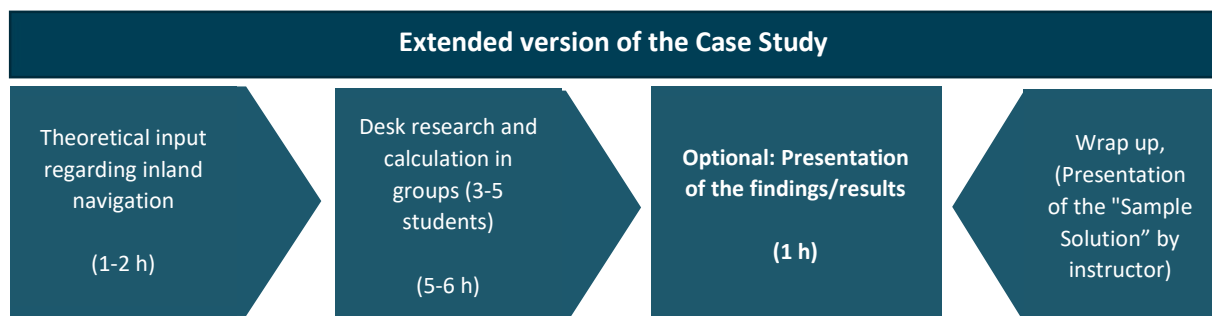
The students receive the case study as an assignment which must be elaborated in groups of students with one group consisting of ideally, three to five students. Ideally the students receive the story before the course with the task to read it and then come to the course prepared. During the class, a theoretical input on the topic of inland navigation that addresses the learning aims of the case study will be presented. After this theoretical input, the students receive an excel file with the shipment-data to deal with. Depending on the expertise of the students, the first two or three shipments can be calculated together with the instructor to gain a common understanding.



#### Extended version (7-9 hours in class)

In the extended version of the case study, the students receive also an an initial theoretical input first, such regarding the characteristics of inland waterway transportation, multimodal transport on the Danube or transport emissions. The duration of the course might be adapted to a single day, up to two full days or three to four half days. The amount and type of information depends on the instructor.

After the theoretical input, the students are provided with the case study in groups of three to five students. The extended version also contains desk research regarding container transports on the Danube, therefore the students are encouraged to conduct research on the web and in scientific databases to be able to develop a greater understanding for the case study. After the desk research the students can start with the calculation of the given data. Optionally each group presents its solutions in a presentation with a maximum of ten minutes.



## 4 Tasks

### Light version:

Data analysis: follow the procedure in the excel file

- Cost analysis
  - Analysis of potential shipments which can be shifted to the Danube based on a positive turnover (comparison road/waterway)
  - Create a cost calculation with the expected turnover
  - To proceed the data analysis, follow the procedure below
- Emissions analysis
  - Calculate the transport emissions of road and inland waterway transport using the GLEC-Framework: <https://www.smartfreightcentre.org/en/how-to-implement-items/what-is-glec-framework/58/>
  - Define and explain the correct emission value (g/tkm) for the used truck and vessel

### Extended version:

- Desk Research
  - What is the current container transport status on the Danube?
  - Are there any uncertain bottlenecks on the Danube? (bridges, water levels, fairway depth)
  - Which current transport flows do exist on the Danube?
  - What is the current feasibility of container transport on the Danube, and how might this develop in the future?
  - Analyze strengths, weaknesses, opportunities and threats of transportation on the Danube
- Cost analysis
  - Analysis of potential shipments which can be shifted to the Danube based on a positive turnover (comparison road/waterway)
  - Create a cost calculation with the expected turnover
  - To proceed the data analysis, follow the procedure
- Emissions analysis
  - Calculate the transport emissions of road and inland waterway transport using the GLEC-Framework: <https://www.smartfreightcentre.org/en/how-to-implement-items/what-is-glec-framework/58/>
  - Define and explain the correct emission value (g/tkm) for the used truck and vessel

## 5 Data analysis

The students will receive an excel file with the relevant data for the data analysis. In this excel file, 100 different shipment orders are listed with information regarding loading- and unloading station, shipping tons, defined running time by customer, truck kilometer and revenue by clients. Then the following procedure guides the students through the calculation process:

Step	Excel column	Description
Step 1	1) total costs road	Calculate the costs by truck: - import (RO-AT): truck kilometer * € 1,15 costs/km - export (AT-RO): truck kilometer * € 1,20 costs/km
Step 2		Calculate the total costs of each route ((Danube-kilometer * € 0,46 costs/km) + handling costs of the loading- and unloading port)
Step 3	2) transit time and defined running time analysis	The transit times on the Danube must be extended by minimum one day each for the first mile and last mile. This results in a transit time of at least 8 days for shipments on the Danube. As a result, shipments with a "defined running time by customer" of less than 8 days no longer have to be taken into account. Mark these shipments with "transit time ok" or "transit time too high"
Step 4	3) loading port	Based on the loading place define the right loading port, regarding costs and distance
Step 5	4) unloading port	Based on the unloading place define the right loading port, regarding costs and distance
Step 6	5) first mile km	Check the first mile km of each transport (from loading place to port)
Step 7	6) last mile km	Check the last mile km of each transport (from port to unloading place)
Step 8	7) first mile costs	Calculate the first mile costs (fix costs + (costs /km * km))
Step 9	8) last mile costs	Calculate the last mile costs (fix costs + (costs /km * km))
Step 10	9) main run costs by ship	Insert the shipping costs on the Danube based on the calculation of step 3 and the defined ports
Step 11	10) total costs waterway	Create a sum of the total costs of each shipment (first- and last mile costs + main run costs by ship)
Step 12	11) shifting savings	Calculate the difference between total costs road and total costs waterway
Step 13	12) shifting (Yes/No)	Define based on a positive output which shipments can be shifted to the Danube
Step 14	13) CO2e emissions road	Calculate the road emissions based on the GLEC Framework (GLEC 75 CO2e (g/tkm) WTW)
Step 15	14) CO2e emissions first and last mile	Calculate the last- and first-mile emissions based on the GLEC Framework (GLEC 75 CO2e (g/tkm) WTW)
Step 16	15) CO2e emissions main run waterway	Calculate the main run waterway based on the GLEC Framework (GLEC 19 CO2e (g/tkm))
Step 17	16) total CO2e emissions waterway	Create a sum of the total emissions of each shipment based on road and on waterway transportation
Step 18	17) CO2e savings road/waterway	Compare the total emissions of road to the total emissions waterway

## 6 Evaluation

Within the case study a sample solution will be provided. Due to differences in kilometer calculation, results may vary slightly. The Sample Solution is used to give students an overview of what the correct calculation would be after completion. A detailed explanation of the emission calculation is also included there. The instructors are advised to only show the Sample Solution in class and not to pass it on to the students in order to avoid passing it on to the next case-study users.