Eco-friendly, safe and economically feasible energy concepts and technologies for European Inland Shipping

A Case Study

Teaching Note

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Content

This case study is a discussion/design case that requires students to work out their own solution on a real-life base scenario. The case examines the development of a eco-friendly transport solution, with a defined focus on the European inland waterways as an eco-friendly and efficient mode of transport. It is drawn around PTC, a Dutch cooperation of independent entrepreneurs in inland navigation and their prospective customer. Which is Holland Hospital, a newbuild hospital in the Nieuwe Bospolder, municipality of Hendrik-Ido-Ambacht (the Netherlands).

Therefore, real data are provided to the students, including – to a certain extend - the construction specifications of green field building a hospital as well as the related shipment data from European destinations to the Netherlands. The students are required to analyse the data and consider the information they get for creating their transport solution, in the form of a commercial proposal. This solution will land in a quotation and underlying proposal. They are invited to consider different transport modalities in order to process the shipment data and combine transport orders with the most suitable transport modality. This consideration of orders and available transport options should function as a basis when the students develop their eco-friendly transport solution. Basically the development of this transport solution includes:

- the analysis of the pick-up addresses,
- the analysis of given information, such as technical data, order specifications and shipment data,
- the application of a smart logistics concept based on handling, loading/discharge, network optimization, bundling, just-in-time delivery, etc
- the understanding of different modes of transport and
- the concept of multimodality and intermodality (partly use of intermodal containers), which requires the understanding of the applicability of different modes of transport to carry different goods.

Furthermore, students are required to present the solution during a 15 minutes presentation followed by a 15 minutes discussion. During their work students should document the progress of their work in an online blog.

Target Group

The case is primarily recommended for logistics students on a bachelor or master level. An interest in transport modalities, construction logistics or hospital logistics or experience in management disciplines is supposed to be supportive. The recommended group size consists out of four students.

For students in the propaedeutic phase individual elements of the case study are available. Think of elements like the analysis of the data set, the understanding and application of different modes of transport, the understanding and application of multimodality and intermodality or the creation of a (winning) quotation. It is recommended to offer the integral, extensive version of this case study only to graduation/minor students.

Structure of Course Integration

The Case Study is part of a course that consists out of three individual project meetings with a time lag of for instance one month each, as shown in Figure 1. In the first meeting, students should receive information about the characteristics of transport modes, the European inland waterway system and the way different transport modes can be combined to multimodal or intermodal transport solutions. The amount and the type of information are depending on the tutor and the 'maturity' of the groups. A list of links that may be used as a resource for the meeting can be found in the last section of this document. The students are furthermore provided with the case study during the first meeting.

Before the second meeting, students have to read the case study, gain specific information concerning the topics mentioned within the case and compare different modes of transports with regard to the requirements that are given in the case. They decide which mode(s) of transport could be used, but they do not work out a certain transport solution in detail. Students should think about a transport solution draft that they can give reasons for and present that draft to their colleagues and the tutor during the second project meeting. The transport solution draft is discussed within the second meeting and the tutor provides feedback. If necessary, the tutor also has the possibility to draw the attention of the students to a certain transport mode which may appear more suitable, e.g. to the inland waterway.

Between the second and the third project meeting, students work out the transport solution in detail, taking the information provided in the case study, the feedback provided by the tutor within the second meeting and the information gained through self-study into account. By the third meeting, students have worked out the transportation solution and present it to their colleagues and the tutor. A representative of the company may be asked to participate in the project meeting, as far as this is desired by both the tutor and the representative of the company. The presentation of the proposed solution and the way it was developed should take about 15 minutes and is followed by a 15 minutes discussion to put the students in a position to argue and give reason for the decisions they have taken. The tutor should ensure that all of the learning aims are being covered by the students.

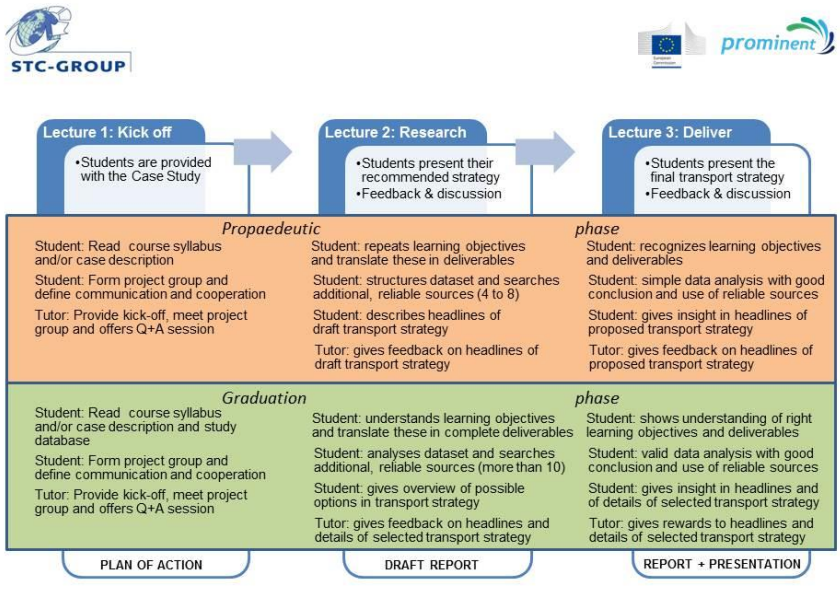

Figure 1: Design of the course

Learning objectives

After the course, students:

- have the ability to explain the basic characteristics (i.e. environmental impact, infrastructure, commodity groups & markets, timing), the advantages and the disadvantages as well as the applicability of (European) rail, road, inland waterway transport and multimodal or intermodal transport of the considered cargo types;
- have fundamental knowledge of the current and developing European inland waterway network, including the European transport geography and gateways to neighbouring third countries;
- have a understanding of the characteristics of inland waterway transportation including the integration of inland water vessels within multimodal/intermodal transportation concepts,
- are able to explain the concepts of network optimization, multimodality and discuss its application in certain transport cases;
- are able to select and introduce smart logistics in the handling and transportation of the considered cargo types;
- are able to formulate a well-organized and eco-friendly transport strategy on a real-life case basis and
- are able to present and discuss their strategy within 30 minutes in a well-structured, professional and arguable way.

Tasks

Students have to:

- Identify the advantages and disadvantages of different transport modes and compare the transport modes with regard to the transportation of construction materials, building facilities and hospital equipments as mentioned in the case as well as consider possible ways of transportation based on the European transport network;
- Evaluate the characteristics of different transport modes and decide for one mode of transport or combination of modes of transport to create an eco-friendly transport solution draft at the moment of the second meeting;
- present the transport solution draft during the second project meeting and give reason why they have chosen a certain mode of transport or a certain combination of modes of transport;
- develop an eco-friendly transport solution for construction materials, building facilities and hospital equipments for selected transport routes, as mentioned in the case, based on the draft and the feedback of their tutor. Therefore, students need to consider economic and ecological factors and, if possible and/or necessary, combine the identified modes of transport;
- make use of the data provided within the case, to guarantee a reasonable line of argumentation;
- create a well-structured presentation of 15 minutes, followed by a 15 minutes discussion, to introduce the transport solution and argue the decisions that have been taken, e.g. why the use of a certain mode of transport is recommended.

To enhance the exchange and sharing of information, it is recommended that the students document the progress of their work in an online blog, like those that can be created within the learning management system "ILIAS", or in another suitable way.

Analytical Framework

It is essential for students to know the European transport network and geography and the basic characteristics and applicability of European rail, road and inland waterway transport as well as multimodal and intermodal transport. Furthermore, suitable modes of transport should be applied according to prior analyzed requirements, such as product characteristics, shipment volumes or available infrastructure. The results of the analysis are used for synthetization to generate a transport solution that fulfills specific requirements that are pre-given in the case. Finally, the student's transport solution is presented during the final meeting within a 15 minutes presentation that is followed by a 15 minutes discussion.
Due to the work in small groups of up to four participants, bachelor or master students additionally improve their interpersonal skills and train the structured approach to problem solving, organization within a team and team cooperation. Presentations of the results enhance their presentation skills.

Data Analysis

The students are provided with the shipment data of approximately 18 months (based on the project timeline of 1.5 years) that include the type of goods, mass, quantity and dimensions as well as the lead time of shipment. In addition, information regarding the packaging and the handling restrictions of each machine are provided. Those goods can either be put onto wooden pallets, consolidated as neo-bulk or in intermodal containers or be transported as single units or unpackaged. Handling restrictions include the possibilities to move the heavy pieces by fork lift, by crane or by towing machines, which most of the time involves tower cranes and/or construction machines.

The data are provided within a Microsoft Excel table (*Construction site deliveries.xlsx*) that consists of 85 data records that needs combining with the construction stages in the course syllabus. Every record represents one type of good (construction or hospital related) that needs transportation. The objective of the data analysis is that students analyse the data and gain knowledge about the flow of goods and the specifications of individual good types. For example, if the data records are being sorted ascending by the size of shipment, it can be seen that the waste water unit is huge and therefore not suited for transport by rail or road.

Based on the data for construction phase Site Preparation, the removal and replacement of demolition debris and soil is a huge effort. The volumes are big and the students need extra information (other tabs in the same spreadsheet!) in order to calculate the transport volumes. This information can be used by the students in order to compare e.g. the economic impact of truck or rail shipments with the economic impact of a multimodal or intermodal transport solution that

includes inland waterway transport. Additionally, the spreadsheet shows the CO2 emission (official Dutch source) and some construction related calculations. It is up to the lecturers to decide to hand over these tools or to communicate to the students that it is part of their assignment to do research on emission and construction management tools. Apart from the spreadsheet a software program like PC Navigo is recommended in order to calculate sailing distances from A to B, but even more important sailing times based on different inland shipping vessels.

Evaluation

The evaluation of the case study itself consists out of two parts: the grading rubric, that includes defined criteria and aspires towards a quantitative evaluation method, and the peer-evaluation-form, that gives the students the opportunity to give feedback about the level of participation and intra-group communication to identify those who did not actively take part.

The students' performance is evaluated with the help of a rubric, a scoring table, which can be seen in Figure 2 and which is provided together with the case documents. The table features seven different criteria that refer to the transport strategy as well as to its presentation. These criteria need to be scored by the tutor. These are:

- Quality of research,
- Structure of presentation,
- Organization of arguments,
- Feasibility of solution presented,
- Intra-group dynamics,
- Evidence of consideration of all case factors,
- Multiple resolutions of the same scenario issue.

Rubric

To simplify and objectivize the evaluation process, scoring is done by referring to qualitative statements that apply to each criterion, which is available in a Microsoft Excel-file (*Evaluation Rubric.xlsx*). Every statement equals a number. The final score is obtained as the sum of the numbers.

	Insufficient	Sufficient	Good	Excellent
Quality of Research				
Structure of Presentation				
Organisation of Arguments				
Feasibility of Solution presented				
Intra-group Dynamics				
Evidence of consideration of all case factors				
Multiple resolutions of the same scenario issue				

Figure 2: Evaluation rubric.

The individual criteria are calculated by the sum of the following values:

- Insufficient: 0
- Sufficient: 2
- Good: 4
- Excellent: 6

Each criterion is described in order to ensure objectivism during judgment. For the used criteria, descriptions are defined as stated in the following Figure 3:

	Insufficient	Sufficient	Good	Excellent
Quality of Research	Students worked out their transport strategy as an overview. There are significant errors. Information regarding sources cannot be provided.	Students worked out their transport strategy with minor errors and some details missing. Information about the used sources can be provided partly.	Students worked out their transport strategy with some details and can give information about the sources they used.	Students worked out their transport strategy highly detailed and can give detailed and specific information about the sources they used.
Structure of Presentation	The presentation does not meet with the 20 minutes timeframe, appears to be inconsistent and gives an overview about the transport strategy that has been developed. Relevant details of the transport process are missing.	The presentation does meet with the 20 minutes timeframe, appears to be partly inconsistent and gives an overview about the transport strategy that has been developed. Some details of the transport process are be missing or be worked out poorly.	Students present their strategy in a presentation that is not significantly longer or shorter than 20 minutes. The transport strategy is explained in an understandable way with an appropriate level of details.	Students present their strategy in a presentation that is not significantly longer or shorter than 20 minutes. The transport strategy is explained in an understandable way with an appropriate level of details, including the decisions that have been taken. The students have prepared back-up-slides for the following discussion.
Organisation of Arguments	Students cannot give reason for the decisions taken. They do not know the relevant advantages and disadvantages of their proposal and can poorly argue how they developed the transport strategy.	Students can give reason for the main decisions taken and know some of the advantages and disadvantages of their proposal.	Students can give reason for the main decisions taken and know the advantages and disadvantages of their proposal. They can explain how they developed their transport strategy.	Students can give reason for every decision taken, know the specific advantages and disadvantages of their proposal and can explain in details how they developed their transport strategy.
Feasibility of Solution presented	The transport strategy is not feasible for the case study.	The transport strategy is missing some details in a way that the transport strategy is partly feasible.	The transport strategy considers the main details and is feasible for the case study.	The transport strategy is feasible for the case study and considers all relevant details, such as details regarding the interconnection of different transport modes or the appropriate loading and unloading processes.

Intra-group Dynamics	Group-work and the presentation are accompanied by intra-group discussions, disagreements and discrepancies.	The students appear as a group. Discrepancies are noticeable, the presentation appears to be slightly unprofessional.	The students appear as a team. Minor discrepancies are noticeable, e.g. during the presentation, that appear slightly unprofessional but planned.	The students appear as a homogeneous team. The presentation appears to be professional and planned.
Evidence of consideration of all case factors	Students present a transport strategy without considering economic or ecological factors as well as the requirements stated in the case (e.g. size of the machines).	Students present a transport strategy and mainly considered at least some economic or ecological factors as well as most of the requirements stated in the case (e.g. size of the machines). Within a multimodal solution the students have barely considered the main specifications of each used mode of transport.	Students present a eco-friendly transport strategy and mainly considered economic and ecological factors as well as the requirements stated in the case (e.g. size of the machines). Within a multimodal solution the students considered the main specifications of each used mode of transport.	Students present a eco-friendly transport strategy and considered economic and ecological factors as well as the requirements stated in the case (e.g. size of the machines). Within a multimodal solution the students considered the individual specifications of each used mode of transport.
Multiple resolutions of the same scenario issue	Students did not respect possible risks within their transport strategy.	Students have respected possible threats within their transport strategy.	Students have respected possible threats within their transport strategy and are able to present them.	Students have respected possible threats within their transport strategy and are able to discuss them when asked.

Figure 3: Criteria definition for the rubric.

It is important to note that the criterion of intra-group dynamics should refer to the impression that the tutor has of the behaviour and the appearance of the group as a team. It does not reflect the way tasks were divided between several team members or to which individual team members took part during the group work. To identify students who participated at a significantly low level or not at all, a peer-evaluation-form should be handed out to the students.

The peer-evaluation-form (*Evaluation Form.pdf*) enables the students to evaluate the members of their team with regard of the individual dedication to work. For every team member, a student can assign ten points, which means in a team of five, every student has 40 points to assign. The maximum score per member is limited by 15. An average score of seven or below is considered a negative grade. Students that contributed equally are expected to assign ten points to each other. If one participated more or less within the course, more or less points should be assigned. However, a deviation from the average of ten points needs to be argued on the form. This form itself is handed over to the tutor of the course. Usually the scores move between eight and twelve points, which is considered to be normal and which is supposed to not have any consequences. If individual students get a significantly high score, this might be considered by the tutor in regard of the final grades these students get. If individual students constantly get a significantly low score, this should not directly result to an effectively negative grading, but should lead to a bilateral discussion between the instructor and the affected student or – possibly in a second step if no solution can be found – between the whole group and the tutor.

Additional Information and sources

The additional information provided within a separate document is a required preparation for the students to get an overview on the general European traffic geography and means of transport.

European Traffic Geography

http://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/map/maps.html
https://www.bmvit.gv.at/service/faktenblaetter/tent.pdf
http://www.inlandnavigation.eu/media/33990/Map_Europe_VIA_2014.pdf
http://www.unece.org/fileadmin/DAM/trans/doc/finaldocs/sc3/ECE-TRANS-SC3-144r1e.pdf
http://www.european-waterways.eu/e/index.php

The River Danube and Inland Waterway Transport

http://www.rewway.at
http://www.viadonau.org/
http://www.danube-logistics.info/
http://www.doris.bmvit.gv.at/en/

The River Rhine and Inland Waterway Transport

http://www.inland-navigation.org/
http://www.ccr-zkr.org/12030100-en.html
http://www.rotterdamportinfo.com/inland-shipping-b73

Construction

http://www.breeam.nl
https://aec-business.com/logistics-key-construction-site/