REPORT ON DEVELOPMENT AND FUTURE USE OF TOOL FOR THE PROMOTION OF MODAL SHIFT OF CHEMICAL GOODS

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1. Introduction

As the future of the transport market will confront respective actors with several challenging factors, those companies need to broaden their perspectives and embark on a change process. Increasing transport volumes, shortage of truck drivers, bottlenecks on motorways but also capacity shortage of terminals are only some of the challenges, which will force companies to restructure their current transport strategies.

In former times, chemical companies themselves executed transporting and handling activities of hazardous goods. Chemical companies that have an own truck fleet at their disposal executed transport with the respective trucks. Activities such as storing, internal goods handling, resource planning in terms of available equipment such as trucks and scheduling were listed among the chemical company's responsibilities. Nevertheless, operative transport of hazardous goods was increasingly executed by LSPs. Due to ongoing restructuring within the chemical industry, outsourcing of logistics-related activities gained in attractiveness. In addition, since such activities do not contribute value to the product, companies either started to transfer the duty to external Logistics Service Providers or established a spin-off by outsourcing their transport-planning department. This means that the outsourced department represents an independent entity, whereas the ownership remains within the parent company. This constitutes a possibility to have the necessary expertise in terms of hazardous goods handling at their disposal. In particular, due to security and safety reasons such expertise is crucial.1 As an example, the Orleon Group in the Czech Republic can be mentioned, as their spin-off Unipetrol Doprava specializes in organizing and executing transport activities.2

However, chemical companies that outsourced the entire transport and related activities are common to provide the LSP with certain requirements related to locations, duration and price. Therefore, the chemical company relies on the LSP to prepare an adequate offer.3 Any company that undertakes the conveyance, packaging, loading, filling or unloading of dangerous goods is requested to have one or more safety advisors, which is commonly termed as a dangerous goods officer. Tasks related to this position consist of preventing risks, which might be induced by the environment or humans.4 Besides qualified employees, the execution of chemical logistics, including transport activities, requires special technical equipment. Terminals need to be equipped with catch basins to guarantee secure handling and storing of dangerous goods. Therefore,

[1] Grap and Milnickel (2011, pp. 13)
[2] Unipetrol Doprava s.r.a. (n.d.)
[3] Grap and Milnickel (2011, pp. 13)
[4] OTIF - Intergovernmental Organisation for International Carriage by Rail (p. 77)

terminals handling hazardous goods need to take additional investments.5 A decreasing number of qualified personnel in the truck-driving sector might serve as a chance to switch multimodal transport. However, this is only possible if the train drivers possess the necessary qualifications e.g. language skills.

Further investigations of the topic have shown that the transport business is merely focused on an economic aspects rather than executing ecological and safety-related transport. This coincides to a certain extent with the transport of chemical goods as freight forwarders receive the order to transport at minimum costs. According to a study of Reniers (2012), 53 % of transport decisions are solely based on costs and only three per cent of the chemical companies base their decision on safety. The remaining part tries to find a balance between costs and safety. Nevertheless, as incidents or even accidents while carrying hazardous goods pose the potential to cause harm to the environment and people, safety plays a critical role in this branch.6

In the course of the analysis of the interviews regarding multimodal transports of chemical goods, it became obvious that the possibilities to transport in a multimodal manner tend to be not well known among chemical companies. Some LSPs simply do not offer that type of transport, as their customers do not request it. They define their offer according to the given parameters such as time of pick-up and delivery and (lowest) costs. Therefore, it is concluded that a chemical company primarily engages the LSP with activities related to transport and does not necessarily check on alternatives themselves.

To achieve the aim of triggering a modal shift by convincing the chemical company to consider multimodal transport as an alternative way of transport, the chemical company needs to be provided with a toolbox that creates awareness for multimodal transport. In addition, it should point out the advantages of this type of transport. This toolbox enables the user to receive information of alternative transport possibilities:

- D.T1.2.6 IT Visualization of transport flows: Intermodal Links Planner
- D.T1.2.7 Planning Guidelines for increasing multimodal transport
- D.T1.2.8 Consulting Service for chemical companies to improve multimodal transport
- D.T1.2.9 Measuring CO2 footprint of chemical logistics

In addition the analysis of the interviews carried out provide reason to assume that the success of identifying potential modal shift address the shipper, as this one is most powerful when deciding in terms of transport. This means that the idea was to access the supply chain at an early stage and create awareness at the shipper's side instead of using the LSP as a transmitter of the idea of multimodal dangerous goods transport.

[5] Moritz (2017, p. 62)
[6] Reniers (2012, p. 72)

Thereby a top-down reaction is expected, whereby the chemical company brings up the topic of multimodal transport as an alternative when discussing transport-related activities with the LSP. Thus, the design of the toolbox corresponds to the needs of the shipper and is anticipated to be used by this actor. Once again, chemical companies do not put their focus on figuring out the most suitable way of transport – this responsibility remains with the LSP. Therefore, D.T1.2.6 IT Visualization of transport flows: Intermodal Links Planner aims to provide the chemical company with information of possible transport routes and respective LSPs. To capture necessary facts such as type and state of product, volume, distances, differing national regulations, loading regulations and required number of transport units, D.T1.2.7 Planning Guidelines for increasing multimodal transport, were established.. D.T1.2.8 Consulting Service for chemical companies to improve multimodal transport serves as a moderating framework for hosting workshops, bilateral meetings etc. while discussing the potential to shift. In order to tackle the environmental aspect, the development of a CO2 Calculator, which is based on the findings of Alan McKinnon (2011), was focused.

The mentioned toolbox should not only illustrate alternative routes, it should also create awareness for multimodal transport, in particular in the chemical industry. Actors need to be made aware of the possibility to move away from unimodal road transport and consider the combination of different transport modes during the transport decision-making process as a beneficial alternative. Thus, the project strives for direct contact with the future users of the toolbox. Noteworthy to mention is that the use of the toolbox is not exclusively restricted to chemical companies, also LSPs are asked to provide their feedback in relation to the suitability and usability of the single elements.

1.1. Relevance of the Toolbox

During the first phase of the project, the partners carried out interviews with Logistics Service Providers, chemical companies, terminal operators and other relevant stakeholders. The following step included an analysis of the data received from the practitioners and every partner country delivered a report. Based on the analysis the project team put their focus on developing a toolbox that fulfils the practitioner’s requirements and triggers a change in one’s mind in terms of multimodal transport. The target group of the toolbox are primarily chemical companies and Logistics Service Providers.

The toolbox aims to ensure information transparency. On the one hand, this means that producing and transporting companies should be able to receive information about multimodal infrastructure (railway, waterway, terminals, pre- and post-haul). Additionally, information regarding existing connections, visualization of single connections, LSPs operating on such connections, transhipment terminals and the

possibility to handle dangerous goods are supposed to be displayed by the element 1.2.6 IT Visualization.

On the other hand, the environmental aspect is tackled by the element 1.2.9 CO2 Calculator. CO2 emissions have gained in importance over the last couple of years. Not only the European Commission7 but also industrial companies obliged themselves to align their CO2 emissions with the intentions set by the legal authorities. In particular, chemical companies might benefit from a reduction of CO2 emission and calculate such savings by the use of the CO2 calculator. Nevertheless, the developed calculator intends to provide the user with an easy and quick way to measure the emission caused by the transport mode. As the current measurement of CO2 is not obligatory and rarely requested, the CO2 calculator is an additional decision support gadget but potentially does not have a major impact on the transport mode decision. Nevertheless, in the end the CO2 calculator could trigger a mind-change once the necessary regulations are introduced.

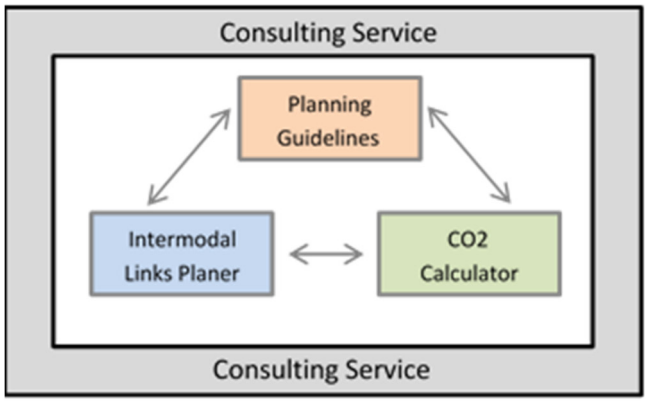
In addition, the project partners are following the intention to create a match-making between supply and demand. Chemical companies are willing to transport multimodal if certain circumstances are fulfilled and the market conditions allow the offer of a competitive alternative to road transport. This is supposed to be attained by the execution of several workshops e.g. Stakeholder Meetings, Pilot Workshops etc. during the lifetime of the project. Consulting Services embody the framework for carrying out such workshops and moderating activities between the relevant corporative actors. More detailed information is provided in chapter 5 Consulting Service.

Finally, all the information received when using the elements IT Visualization and CO2 calculator are captured in the Excel sheet, which demonstrate the third element 1.2.7 Planning Guidelines. The guidelines serve as an output sheet whereby most important indicators related to multimodal transport are gathered. Such indicators are product type, volume, countries crossed along the route with respective driving and loading regulations, bundling options to achieve a more efficient use of capacities and the number of transport units are shown. This number is based on the volumes (tons or litres) foreseen for the transport.

For the upcoming chapter and for a better understanding of the toolbox the following graph provides an informative overview. The frame demonstrates the element Consulting Service, which embrace the remaining parts of the toolbox. Thereby it is signalized that the frame builds the necessary environment e.g. bilateral meetings to test and apply Planning Guidelines, Intermodal Links Planner and CO2 Calculator. Within the frame, the both-sided arrows underline the interrelatedness between the single toolbox elements.

[7] European Commission (2011)

Fig. 1: Interaction of Toolbox Elements



Before diving right into a more detailed explanation of the single toolbox elements, the paper continues with a description of the elaboration of the toolbox.

2. Methodology

The scientific project consortium decided on separating the elaboration of the single toolbox elements among isw (PP3),OvGU (PP4), FHOOE (PP9) and SGH (PP14). Isw designed the initial approach on how to elaborate the single toolbox elements and within a Skype conference, the tasks were split up. This procedure aimed to ensure a structured processing of the work packages. During the progress of the toolbox development also the remaining project partners were requested to generate input and provide feedback – especially in terms of the planned peer review (1.2.5). However, in order to allow the reader to establish a connection between the initial approach and the elaborated beta-version, table 1 lists facts regarding the deliverable, title and description. After the project-internal review of the beta-version in form of Deliverable 1.2.5 Peer Review, the toolbox will be used in the course of the pilot activities. After that, the toolbox will be reviewed one more time during the Dissemination Conference in Italy. This event will take place in June 2018 (according to the status).

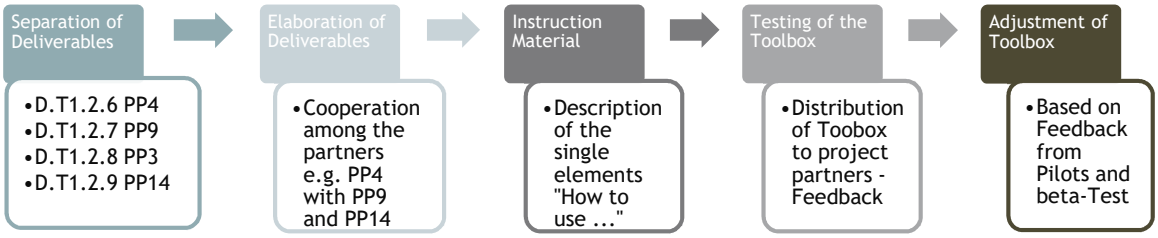
Tab. 1: Initial Approach Toolbox Elements

Deliverable	**T1.2.6**	**T1.2.7**	**T1.2.8**	**T1.2.9**
Title	IT Visualization	Planning Guidelines	Consulting Service	CO2 Calculator
Short Description and Initial Approach	The partners will develop an ICT solution that uses the data from analysis and single company data collected in the course of the pilots to visualise transport flows for the identification of potential of modal shift	Based on the results from analysis on strengths and weaknesses of multimodal transport the partners will formulate guidelines for promoting modal shift at company level	Partners will develop an approach for implementing consulting services in close cooperation with chemical companies to discuss current transport patterns, existing potentials and possible actions to promote modal shift.	Partners will develop a method to calculate CO2 footprint of chemical transports on different modes to demonstrate reduction of CO2 emissions after implementation of modal shift as contribution to sustainable development

Once the single Deliverables were separated among the scientific partners, the partners started to elaborate the elements. Figure 2 provides a comprehensive overview on the separate development stages of the toolbox. It also shows the separation of the single toolbox elements. During the elaboration of the single elements, the partners tried to always refer to the initial approach, which was defined by the isw while designing the application form of the project. Based on this the project partners started to generate relevant ideas for the single elements and cooperated in case of suitability. As an exemplary case, the cooperation between OvGU (PP4) and SGH (PP14) can be mentioned due to the mutual development of the CO2 calculator. While PP14 prepared the scientific base, PP9 transferred the ideas and insights into an online tool. PP4 possesses the competencies to set up a CO2 Calculator, whereas PP14 focused on the scientific elaboration. A similar picture is to be observed for the elaboration of the Planning Guidelines. The Excel sheet was developed in cooperation with PP4. Necessary input such as national driving ad loading regulations was either requested from the project partners or gathered by asking some expert from the industry.

As soon as the beta version of the toolbox elements was elaborated, the FHOÖ generated instruction material on how to use the toolbox. This intends to facilitate the toolbox, considering the interaction of the single elements. In addition, a standardized presentation was made available to the project partners via the cloud. The presentation is standardized and project partners might use it as an introduction of the toolbox, but it should also provide an overview of the project and the pilot activities. Once the elements were finished for the testing phase (1.2.5 Peer Review), all elements and respective material was made available in the project cloud. Hence, project partners were asked to access the cloud, download the necessary documents, test the toolbox and provide feedback. This feedback was returned to FHOÖ, who was responsible for collecting the feedback and drawing appropriate conclusions. In the course of the feedback evaluation, statements were clustered and assigned to a category. Category one is defined by statements that are out of the project's scope and category two includes statements that cohere with the purpose of the toolbox. Based on the feedback that was received from the partner's peer review, the toolbox will be adjusted accordingly.

Fig. 2: Progress of Development



The project partners, who were primarily participating in the development of the toolbox and its respective elements, were asked to capture their proceedings, issues etc. during the elaboration phase. Those proceedings and a short introduction on how to use the toolbox are stated in the upcoming chapters.

3. IT Visualisation

The Goal of this work package is to identify and provide a suitable IT tool to visualize multimodal transport routes. This tool will be used in the framework of the ChemMultimodal Toolbox. For this purpose all partners did a recherché in their regions and used a template to describe the different tools with the aim to choose a suitable already existing tool or to make a choice to develop an own IT tool.

The existing tool “Intermodal Links” got good results in this analysis. It fulfils the core requirements like European wide availability, high topicality of the routes and connections, integration of different transport modes, etc. The developers of Intermodal Links a very open for new ideas and improvements and a close partnership has evolved. This gives the ChemMultimodal project the opportunity to directly influence the further development of the tool regarding the specific needs of the chemical industry.

3.1. Methodical Approach

To collect a wide range of different, already existing visualization tools from the partner regions, a template was developed. This template is divided into five subtopics:

1. General information about the tool,
2. Provided terminal information,
3. Provided operator information,
4. Planning features,
5. Usability.

3.1.1. General information about the tool

First of all the template collects general information about the tool and the provider of the tool. The attributes “Number of Operators” should be highlighted here, because an important factor for the suitability of the tool is the number of operators of connections and terminals supported by the tool. In addition, the supported languages and supported countries are important. Is the tool free of charge or which price model is used? The quality of the outcomes of the visualization of multimodal transport routes is highly depending on the update frequency of the used basic data. Thus, this information is asked in the template. The way of data integration and data collection is also very important. Do the operators maintain their data by themselves with a login or an automated interface or is the tool provider maintaining the data?

Below all general attributes are summarized:

- Name
- URL
- Provider
- Number of Operators
- Supported Languages
- Included Countries
- Number of Terminals
- Number of Loading Points
- Number of Connections
- Access/ price model
- Update Frequency
- Data Collection

3.1.2. Provided Terminal Information

The visualization of the transport of chemical goods needs information about existing and potential transport connections. In addition, it needs also detailed information about the terminals to consider multimodal handling points and handling capacities. Therefore, in the second part of the template is collected which information the tool provides about terminals. This includes general information (terminal name, address data, operator, etc.), information about regular connections from and to the terminal and supported transport modes. Additional information like capacities for hazardous goods or cleansing stations are also very important especially for the transport of chemical goods.

- Terminal Name
- Adress Data
- Contact
- Operator
- Transport Modes
- Regular Connections
- Handling Capacities for Hazardous Goods
- Information About Additional Services

3.1.3. Provided Operator Information

The part for the operator information is very similar to the terminal part.

- Name
- Adress
- Contact
- Used transport modes
- Regular Connections
- Handling Capacities for Hazardous Goods
- Information About Additional Services

3.1.4. Planning Features

Under this topic, a detailed description of the planning features is intended. Information about the consideration of different transport modes should be provided. How perform the tool a route planning and considers and show the cost?

More detailed description of:

- Provided Transport Modes
- Route Planning Features
- Costs

3.1.5. Usability

The last topic is the usability of the tool. It includes a short qualitative assessment of the tool usage.

With this template, all project partners in the ChemMultimodal project should research existing multimodal visualization tools in their region. The analysis of the completed templates takes place in two steps. First, a rough assessment and prioritization will be made with the attributes from the template. The top three of this first assessment will be analysed more detailed to choose one visualization tool for the use and cooperation in the project.

3.2. Analysis and Prioritisation

For the first part of the assessment a morphology was created. All identified tools were classified in this morphology and a top three were chosen by qualitative assessment:

Tab. 2: Morphology

Range	regional			Europe wide		World wide	
Features	planning				scheduling		
Access	account needed				free access		
Number of Operators	<50	<100		<150		>150	
Modes of Transport	rail			inland waterway	short sea	sea	
Hazardous Goods	information available			information on request		information not available	
Topicality	up to date			periodic updates		irregular Updates	
User Interface	easy to use				training required		

In total ten different visualization tools were researched and described with the template:

- Intermodal Links
- Intermodal Planner
- Intermodal Route Planner
- Visibility Platform
- Railway Tools
- Tablazat Hungary
- Mapa Terminali UTK
- Mapa PLK
- Open Railway Map
- Baltic Transport Map

Four of ten tools are regionally limited, five tools have a European wide scope and one tool is worldwide useable. Six of ten tools support planning and scheduling and four are schedule only. Seven tools can be used free of charge.

The first analysis of all ten tools resulted in the conclusion that only three tools fulfil the minimum requirements of the project. Six of ten supports at minimum European wide actions. Four of this six tools support the required modes of transport (truck and railway) and only three of them support a sufficient number of operators.

The determined top three tools from the first part of the assessment are shown in the following picture:

RT Railway Tools

IRP Intermodal Route Planner

IL Intermodal Links

Tab. 3: Morphology with top three tools classified

Range	regional		Europe wid IL IRP RT	World wide
Features	IL IRP RT planning		IL IRP scheduling RT	
Access	IL IRP account needed		RT free access	
Number of Operators	<50	<100	<150	>150 IL RT IRP
Modes of Transport	IL IRP RT rail		IRP IL inland waterway	short sea IL IRP / sea IL IRP
Hazardous Goods	information available		information on request IL RT	information not available IRP
Topicality	IL up to date IRP		RT periodic updates	irregular Updates
User Interface	IL IRP easy to use RT			training required

3.3. Selection of One Tool for the Project

The characteristics of the top three tools (see morphology) seems to be very similar. There are only smaller, but important differences. Intermodal Links and Railway Tools provides information about hazardous goods on request, whereas this information is not available from the Intermodal Route Planner. In addition the Intermodal Route Planner only exists as a demonstrator and it is not evident that the development of the tool continuous. Railway Tools is a project of DB Netz AG and is very focussed on the activities and services of Deutsche Bahn AG. The intention of the ChemMultimodal project is to use a more neutral tool. The developers of the Intermodal Links tool showed great interest in the project and a possible cooperation.

3.4. Use in ChemMultimodal and Future Outlook

The ChemMultimodal project partners present the possibilities of Intermodal Links to the companies and use it for test cases for planning of potential new multimodal transport. All ChemMultimodal project partners and companies involved in pilot project can use the Intermodal Links Platform for free in the course of the pilot action. Only an individual registration is necessary. After end of project, each organization can decide whether to continue using the platform for a fee, which should be introduced later. The ChemMultimodal project partners will then give feedback and recommendations to Intermodal Links platform in view of improving the platform from perspectives of chemical industry (e.g. hazardous goods transport). Therefore, that for the future use Intermodal Links will try to implement that additional information that is provided by the ChemMultimodal project partners. Some types of information require alterations to the platform that take time and the involvement of the technical partner of Intermodal Links – for those alterations they need to discuss what's possible.

The Chemical Industry has specific information requirements in relation to the terminals their containers are handled and to the tracks their transports are carried out. The additional information should be included in the Intermodal Links platform. That missing information – gathered by the ChemMultimodal project partners – are e.g.:

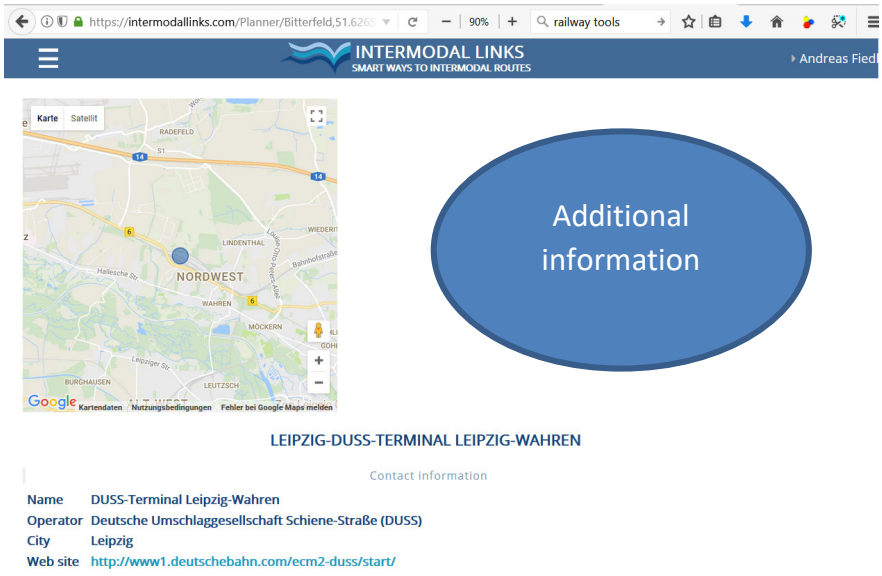
- *Track Information*

That is any restriction that may be in place for the transport of chemicals and/or hazardous goods on the transport lanes and /or tracks. Another important track information is the total distance of track because this information is needed for the Planning Guideline and for the calculation of CO2 emissions reduction. Up to now there is just the distance of pre and end haulage indicated in Intermodal Links.

- *Terminal Information*

That is any restriction for the storage and/or handling of chemicals and/or hazardous goods on the terminal. The information which hazardous goods classes are affected is needed for the logistics service provider. Further more it would be good to know the number of spots available for the storage of bulk containers with hazardous goods and in this context, which hazardous goods classes are allowed or not allowed. Are there any cleaning facilities for bulk containers/tank container available? And in this context: which hazardous goods classes are allowed or not allowed? Further more the information if there is a maintenance shop available or not and in this context: is there any specific service offered? Last but not least some information about the handling of box containers is needed, so is there service available to install PE bags in box containers for the bag-in-the-box-system? Is there service available for the disposal of used bags? And are folk lift trucks available for the loading/reloading of box containers with palletized material?

Fig. 3: Screenshot Intermodal Links



Thus, in Figure 3 you can see the information of a terminal at present. Therefore, the proposal for a detailed description of terminals in Intermodal Links platform is for example.

Tab. 4: Example of terminal description in Intermodal Links

Address	Opening hours
Value Park Z 90 An der Bober 79-103 06258 Schkopau Deutschland KTSK Kombi Terminal Schkopau GmbH Tel. +49 (0)3461 / 745-217 Fax +49 (0)3461 / 745-223 E-mail ulrich.graetz@ktsk-terminal.com Web http://www.ktsk-group.com	Mo 06:00 h - 22:00 h Tu 06:00 h - 22:00 h We 06:00 h - 22:00 h Th 06:00 h - 22:00 h Fr 06:00 h - 22:00 h Sa 08:00 h - 12:00 h Su not specified

Features:

Modes of transport served:

- Rail/ Road

Infrastructure:

- Rail-mounted gantry cranes 2
- max. transloading Weight 40t

Other services

- Container repair / maintenance
- Container cleaning

Dangerous Good (RID/ADR)

- Handling of Dangerous Goods (RID/ADR) possible / which classes
- Storage capacity / which classes / number of spots
- Cleaning services / which classes
- Leakage zone

Transshipment sidings and effective lengths

- Track 1 420 m
- Track 2 420 m

Load units capable of being transshipped

- Container 20'
- Container 30'
- Container 40'
- Container 45'
- Swap body up to 7.82m
- Tank container up to 7.82m
- Swap body

- *Cost Information*

That is any Information about the cost for the above services and of course general cost information for the proposed transport lanes.

With regard to costs it is not possible to simply state that costs are always high when transporting in a combined transport manner. The Planning Guidelines do not provide information in terms of costs due to fluctuating and different sources, which does not guarantee transparency. The user is asked to get in direct contact as soon as he/she found a suitable LSP via the Intermodal Links Planner that provides contact details of LSPs.

Fact is that fixed costs are higher in relation to railway transport as the infrastructure and equipment is more expensive than purchasing a truck.[8] However, depending on factors such as distance and volumes in the first hand and crude oil prices and sufficient infrastructure on the second hand, costs demonstrate a decisive criterion. It has to be differentiated between costs for distance-independent activities e.g. transhipment at terminals and the distance-related ones e.g. operation of the means of transport for the distance covered. Prices are lowest for a truck in terms of independent activities whereas prices are highest for distance-related ones. This means that with every extra kilometre the price for truck becomes higher in relative perspectives to train and barge. Thus, it is suggested to utilize barge or ship for long distances, train for medium distances and trucks for short haulages. This ensures an optimized utilization of every transport mode and cost savings might be triggered. Nevertheless, in case of investments to increase handling efficiency at terminals or by introducing higher tariffs for road transport the attractiveness of train and barge increase[9]. By introducing additional charges on road transport for long-distances and stricter controls regarding resting times of truck drivers the costs for road transport might experience an increase and in turn a decrease in attractiveness results.[10]

Multimodal transport planning is partially influenced by differing national regulations within Europe. Trains crossing boarders are either supposed to switch the train driver except for the case that the train driver speaks the local language. This results in additional time that is need when switching the driver at the boarders and this in turn influences the costs. Language demonstrates only one problem, when it comes to railway transport, different railway gauges, lightning systems and loading and driving regulations pose additional issues. Therefore, the European Commission announced in

[8] Chopra and Meindl (2014, p. 490)

[9] Mathisen et al. (2015, pp. 10)

[10] Sandberg Hanssen, Mathisen, and Jorgensen (2012, p.199)

White Paper (2011), the ambition to strive for a single, unified European transport corridor.[11]

- *Transport Time*

In terms of transit time the opinions between authors differ. According to Babst (2012) a further strength of railway is the likelihood of a punctual departure and/or departure which is due to the infrastructural confinement. Existing and fixed freight transporting schedules contribute to reliable transport planning. Additionally, the possibility of congestions is considered a minor issue.12 Even though that intermodal transport can be considered as solution to encounter congestions, the traffic towards transhipping terminals e.g. ports, railway stations might experience an increase. Therefore, further congestions can be initiated at transhipment points, due to insufficient infrastructure. The request for an infrastructural extensions arises to ensure a sound access to the terminal. Furthermore, transhipments processes are considered as intermediate stops at terminals along the way, which require additional time.13 Currently, the business of combined transport processes suffers from numerous delays due to construction works, especially along the North-South corridor from Benelux to Italy. Reasons why the rail operating companies cannot counter steer, are previously initiated personnel and locomotives cuttings in order to save costs. Thus, LSPs are in the difficult situation to justify the delays in front of their customers. As a consequence the loss of customers and a shift towards road transport is feared. Nevertheless, the construction and extension of infrastructure intend to prepare for increased transport volumes and to offer a greener way of transport.14 Delays and waiting times along the route are expensive as working and fuel costs, which demonstrate 60 % of the overall costs when transporting by railway, are caused as soon as the engine of the train starts. Therefore, a high degree of transport mode utilization is favourable.15

The ChemMultimodal project partners and Intermodal Links will jointly discuss these recommendations. The promotion of Intermodal Links platform can continue in the work package capacity building – where training seminars for further chemical companies are organized. And of course the promotion could also be jointly implemented at European Level in cooperation with Cefic (The European Chemical Industry Council) and European Chemical Regions Network to cover all European Countries.

[11] European Commission (2011)
[12] Babst (2012, p. 323)
[13] Leinbach and Capineri (2007, p. 5)
[14] Klotz (2017, p. 1, p. 8)
[15] Chopra and Meindl (2014, p. 490)

4. Planning Guidelines

4.1. Initial approach

"A list of requirements (see document D.T1.2.4 within "Deliverable D.T1.2.7") were developed in order to analyse the transport framework and suitability of multimodal transport. Those requirements will be elaborated in more detail during the project process. During the elaboration of the planning guidelines a more theoretical approach was focused, thus existing scientific theory was investigated and the practitioners input included. In addition, it was compared with the insights generated through the interviews. As a result, the planning guidelines should serve as a one-stop-shop to facilitate usability."

Initially, the development of a static list of requirements for analysing transport framework and suitability of multimodal transport was foreseen to fulfil this deliverable. However, in the course of the project the partners agreed on an interactive Excel sheet, which requires the user to insert certain data that in turn can be retrieved from the IT Visualization and CO2 Calculator element. All the grey cells are supposed to be filled with content by the user, whereas white cells are interlinked or have a formula running in the background. Therefore, these cells are filled automatically once the data in the grey cells is inserted. As an example, Table 5 demonstrates grey cells that require the user to insert content, whereas Table 9 (see 4.2.4 Bundling) are filled automatically based on the contents inserted previously.

4.2. Development of Planning Guidelines

Transport is defined as the movement of goods from one point to another. Depending on the distance of transport, one either refers to local traffic, which counts up to 50 km, regional traffic, which ranges from 50 to 150 km and long-distance traffic, which includes distances above 150 km. The majority (78 %) of the categories "local" and "regional" traffic is executed via truck, whereas above 150 km the share of road transport declines. This indicates that the remaining 22 % of overall goods' transport were carried on distances above 150 km.16 Thus, it is assumed that above the threshold of 150 km multimodal transport is considered as an option. Still, road transport dominates the transport sector, which is due to its high degree of flexibility.

[16] Pikelj (2012, p. 205)

4.2.1. Product Type

The execution of a transport in a unimodal or multimodal manner is also dependent on the type of product. Thus, the product type needs to be considered because some chemical substances can only be transported under certain temperature, pressure, etc.17 Besides warming and cooling activities during the actual transport, temperature controlled transports concern handling and storage of actively or passively frozen, cooled and warmed goods. In the recent years, temperature-controlled transport increased due to changing consumer behaviour and stricter transport regulations.18 Within the Planning Guidelines, the first section requires the user to insert data regarding the product type. More precisely, information in terms of the dangerous goods class, physical state (solid or liquid can be selected by a drop-down field) and volume (either tons or litres appears respectively).

Tab. 5: Product type information and volumes

Product	
DG class	
Physical state	*liquid/solid*
Volume	*Litres/tons*

4.2.2. Volume and Infrastructure

When transporting in a multimodal manner, the ability to transfer bigger volumes compared to unimodal transport demonstrates an important advantage. Especially in a multimodal manner, when pre- and post-haulage are kept to a minimum, the permitted weight of transport differs. With unimodal transport, the maximum gross weight is limited to 40 tons for a truck, whereas with combined transport the maximum gross weight for trucks is 44 tons.19 Therefore, the actors make use of the possibility to transfer higher volumes and utilize capacities of the transport mode to a greater extent. Apart from this, the actual length of a truck is allowed to exceed the common length by 15 cm when being involved in combined transport.20 Regardless of this, the high transport capacities pose a real advantage compared to road transport. Therefore, the carriage via railways enables shippers and LSPs to transfer between 1.000 and 4.000 tons at once. The high leverage evolves from the type of product transport e.g. steel versus raw materials. In terms of product type, also the density of the transported product is of

[17] FP Transport LLC (2017)
[18] Hofmann and Oettmeier (2016)
[19] Babst (2012, p. 323)
[20] Beuthe (2007, p. 69)

relevance, especially with gaseous or liquid substances. Thus due to the underlying price structure (Euro per ton) and the possibility to transport high volumes by train, intermodal transport poses the ideal mean of transport for large and heavy goods as well as for materials with a high density.21 Current, planned and anticipated developments in terms of infrastructure are gathered in the Strategy and Action Plan, which is part of Work package four (WP4).

The existence of suitable infrastructure and terminals with corresponding equipment serves as a facilitating factor for multimodal transport. Whereas, differences in gauge dimensions, electricity networks or signal systems (technical nature) are hindering cross-border transport by railway. Furthermore, ICT systems will gain in importance as it serves as a factor to speed up transhipment and cross-border transports. Railway operators and infrastructure providers are advised to prepare for intensified use of ICT systems.22 Ideally, the routes are listed in combination with experienced LSPs that offer regular connections or are able to organise appropriate transport connections. Intermodal Links lists LSPs that operate on the routes inserted and selected during the use of the Intermodal Links Planner. Thus, the user has the option to contact the LSP and ask for a specific offer.

4.2.3. Distance and Location of Actors

As multimodal transport becomes an actual alternative once a certain distances is reached. It is inevitable to include a section tackling this aspect. According to Hodea (2012), intermodal transport starts to become an interesting alternative as soon as transporting distances increase. Among practitioners, the number of the minimum transport distance differs between 300 and 500 kilometres.23 Thus, the longer the distance the more attractive is the option of transporting intermodal. Average distances on a national (European) level are 550 km, which would theoretically be an option for multimodal transport. On an international level, distances have an average of 800 km, however, a tendency of growing volumes is anticipated.24

Beuthe (2007) argues that intermodal transport is more costly on short-distance, thus the pioneering role on short-distance haulage will remain with the truck. Attractiveness of combined transport processes rises with distance, but simultaneously organizational efforts, costs and time increase too. Additionally the frequency (daily, weekly) of

[21] Chopra and Meindl (2014, p. 490)
[22] Moritz (2017)
[23] Hodea (2012, p. 608)
[24] Beuthe (2007, p. 70)

connections is depending on the route.25 In terms of so-called racetracks, which show sufficient distances and volumes, daily connections are established.26

Practitioners underlined that multimodal transport needs to reach a certain number of kilometres to consider it as an actual alternative. This threshold, where multimodal transport makes sense (out of an economic perspective), is commonly termed as the break-even-point. At this point multimodal transport brings along monetary advantages in comparison to unimodal transport. As long as this is not achieved, practitioners stick to common road transport. However, other factors such as volume, frequency of departure, transport time, available LSPs, terminals characteristics etc. have an influence on the decision of transport modes. Based on existing literature and practitioner's inputs, one section of the Excel sheet targets the aspect 'distance'. As this is related to the locations, the user is also requested to fil in the locations of the shipping company, departure/arrival terminal and the final destination.

Tab. 6: Location of relevant actors

		Street, Nr.	Postal Code	City	Country
Location	Shipper				
	Departure Terminal				
	Arrival Terminal				
	Destination				

Once the general location information is delivered, the user is asked to insert the respective number of kilometres from one location to another in the cells shown in Table 7. Based on those kilometres the colour of suitability in this section will turn either green, orange or red. As no numbers are inserted in Table 7, the first and last field remain green and the middle one stays red.

[25] Notteboom (2008, p. 67)

[26] Beuthe (2007, p. 72)

Tab. 7: Suitability of route based on distances

	From:	To:	Distance (km)	Suitability
Distance	Shipper	Departure Terminal		
	Departure Terminal	Arrival Terminal		
	Arrival Terminal	Destination		

The different colours and the underlying kilometre range of suitability are illustrated in Table 8. Green signalizes a high suitability, whereas red means that the route is not suitable for multimodal transport as the pre-haul is too long. This has to be evaluated in relation to the total distance. In the ideal case, pre-haul is below 101km, main leg is above 300km and the post-haul is again below 101km. Here, multimodal transport should be executed. If companies are not sure about the kilometres, they can make use of the Intermodal Links Planner (= IT Visualization) to deduce the kilometres for pre- and post-haul. Regarding the total kilometres per route, the operator of the Intermodal Links Planner is currently working on to also display the total distance. Alternatively, users can make use of other online tools.

Tab. 8: Categorization of distances

Shipper to departure terminal	< 101km	101-129km	> 129km
Departure terminal to arrival terminal	<200km	201-299km	>299km
Arrival terminal to destination	< 101km	101-129km	> 129km

Nevertheless, the kilometre range is primarily applicable for inner European transports as the suitability of multimodal transport is strongly dependent on the total kilometres. A transport from any European country towards China is still suitable for multimodal transport via e.g. the FELB (Far-Eastern Land Bridge) even though a pre-haul or post-haul is longer than 129km. Therefore, single routes with respective volumes and additional customer requirements needs to investigated separately instead of basing one's decision of the results of another company.

In order to allow the user a quick and easy access to the Intermodal Links Planner and the CO2 Calculator, forwarding Links are positioned next to the sections Location and Distance.

Fig. 4: Position of Forwarding Links in the Excel Sheet

Location		Street, Nr.	Postal Code	City	Country
	Shipper				
	Departure Terminal				
	Arrival Terminal				
	Destination				

Distance	From:	To:	Distance (km)	Suitable
	Shipper	Departure Terminal		
	Departure Terminal	Arrival Terminal		
	Arrival Terminal	Desti-nation		

4.2.4. Bundling of Transport Flows

The concept of bundling starts at the level of putting parcels on a pallet. The next step is to gather pallets and load them into a container followed by gathering containers to put them on a suitable mode of transport such as train. Terminals serve as bundling locations. This results in handling costs and bears the risk of damage while transhipment and an increase in transit time. Nevertheless, by joint planning and resulting route consolidation an option to realize cost savings in practice is demonstrated.27 Bundling of freight poses the opportunity to utilize spare capacities and make use of economies of scale28, which has a positive effect on operational costs per unit.29 As a consequence of a greater loading factor the costs, which are generated, either neutralize the advantages generated or the advantage outweighs the costs and a better utilization becomes possible. However, when LSPs start to bundle freight volumes and reach certain break-even-points in terms of distance the establishment of further connections is a possible result. Thereby, also the frequency of connections might be increased.

When distributing freight joint route planning poses a possibility to save distribution costs through the effect of bundling. Transport vehicles are utilized more efficiently, cost savings up to 30 % are possible and the amount of kilometres driven are decreased which in turn result in CO2 savings. Those aspects are some precise advantages attained through the utilization of a common distribution centre. Furthermore, it is most beneficial in relation with a high number of partners involved, narrow time windows and large distances e.g. cross-border transport in Europe. Regarding companies involved it has to be noted that SMEs are addressed more intensely than large companies. The latter are able to plan and execute routes even without partnering companies as they have a broad network at their disposal. In addition, the necessary financial resources are available to them.30 Therefore, SMEs see a necessity in cooperating with actors located

[27] Cruijssen et al. (2007b, p. 287)
[28] Notteboom (2008, p. 69)
[29] Kreutzberger (2008, p. 154)
[30] Cruijssen et al. (2007b, pp. 296)

at the same supply chain level to compensate a lack in resources. Eventually, the aim is to remain competitive and survive on the market. In the end, an increase in profits is anticipated, whereas the separation of such demonstrates a critical aspect in horizontal cooperation.31 In case that bundling is an option, but companies are hesitant due to costs or similar, the Strategy and Action Plan might be used for clarification as regional and national development programs are listed in this paper. Thereby the company interested in bundling might detect a program that promotes and funds single wagon transport and thus is able to get in contact with the respective institute.

Different product types show different requirements of transport. Depending on a product type's characteristics the shipper or LSP might be allowed to bundle transport flows. This would facilitate the attainment of sufficient volumes to realize multimodal transport. However, not all dangerous goods are not allowed to be loaded together at the same mode of transport. Thus, the Excel spreadsheet contains a section that provides the user with information about combinable Dangerous Goods classes.

Table 1: Bundling possibility

Tab. 9: Bundling possibility

Bundling	Dangerous goods class	*(automatic fil-in)*
	Combinable DG classes	*(automatic fil-in)*

4.2.5. Loading and Driving Regulations

In contrast to North America or China, the European landscape is characterised by a mosaic of different countries speaking different languages and obeying different rules, which are introduced by different national institutions. Furthermore, technical differences hinder smooth cross-border transports by train or barge. Only those mentioned aspects contribute to challenges faced when aiming for multimodal transport. Cooperation among the players of a multimodal transport chain requires more effort but is considered as an important success factors. Thus, it is of major importance to restructure and reorganize the system e.g. by introducing a paramount regulative framework for the European transport sector in terms of multimodal transport – *inter alia* to enhance cooperation among relevant stakeholders. This would enable multimodal transport to properly compete with unimodal road transport.[32] By now, the European Union developed a document "Roadmap to a Single European Transport Area" that

[31] Cruijssen, Cools, and Dullaert (2007a)
[32] Beuthe (2007, p. 54)

should facilitate more sustainable ways of transport. This document is part of the White Paper 2011.[33]

However, multimodal transport shows benefits in terms of driving restrictions. The majority of European countries have introduced driving bans during the night, on weekends and public holidays. In most of the cases, combined transport is excepted from driving bans, also sectoral ones such as the one on the A12 Inntalautobahn in Austria. Interestingly, individually operating trucks, which are EURO 5 or 6 certified, are permitted. Even though those trucks involved in intermodal transport are not concerned with the driving bans the opening hours and delivery windows of companies need to be considered.[34]

Practitioners mentioned that multimodal transport is more complex in planning and execution phases. This is due to a higher number of actors involved, additional interfering points, regulative and technical differences across countries. As a precise example, transport towards France is more favourable via truck, because differing gauge dimensions let time and cost rise. However, truck transport is constrained by driving restrictions during public holiday, weekends and night times. This might act as a facilitating factor for combined transport as trucks being involved in combined transport are excepted from this regulation. Within the Planning Guidelines the user is able to select those countries that are crossed while transport. The information about the countries crossed can be retrieved from the Intermodal Links planner. Once the user selected the relevant countries, national regulations are shown in the cells below in the Excel sheet. In addition, regulative differences in terms of loading are illustrated. The user is able to select up to five different countries and receives respective information regarding driving (night, weekend, public holiday) and loading regulations. To realize this, the project partners were asked to gather relevant information and deliver it to the OvGU, who included it into the Excel sheet. The intention is to underline the advantages of combined transport as trucks are excepted from the restrictions if they are part of a combined transport chain.

[33] European Commission (2011)

[34] Notteboom (2008, p. 71)

Fig. 5: Differing, national Driving and Loading Regulations

Countries along the route	Austria	Germany

		Austria		Germany	
		Road	**Rail**	**Road**	**Rail**
Driving Restrictions	Night	10p.m. - 5a.m.	Does not apply for combined transport	none	
	Weekend	Saturday 3p.m. - Sunday 10a.m.	Does not apply for combined transport	• On Sundays from 00:00 to 10p.m.	
	Public Holiday	00:00 am to 10:00 pm; On Sundays and public holidays, the weekend driving ban will go seamlessly into the night driving ban from 22:00 until 5:00 o'clock!	Does not apply for combined transport	• On public holidays from 00:00 to 10p.m. • In case of several consecutive holidays or a combination of Sunday and holiday, the driving restriction applies from the first day 00:00 until the last day 10p.m.	

		Austria		Germany	
		Unimodal	**Combined**	**Unimodal**	**Combined**
Loading Regulations	2 axle tractor with 3 axle semitrailer	40t		40t	
	Semitrailer combination used in a		44t		44t
	3-axle tractor + 3-axle semitrailer	40t		40t	
	Road train used in a combined transport		n.a.		44t
	Vehicle combination used otherwise than	n.a.		40t	

4.2.6. Loading Units

Insofar, loading units have an impact on the transport as during the planning phase the actors need to know how many and what type of transport unit is foreseen for carriage. Depending on the type of product and consequently the state (liquid or solid) the transport unit differs. Solid substances are carried in container, which usually cohere

with the ISO norm and liquid substances are carried via tank containers. Due to the variability of tank containers, we contacted the General Manager of Hoyer (Vienna) asked for tank container dimensions. Most common ones were mentioned and included into the Excel sheet. Thereby it is aimed for a better understanding in terms of the required number of transport units and the possibility of using block trains of bundling to achieve a more economic transport solution. The fields are populated as soon as the user inserted the anticipated volumes and the state of the substance. This happens as soon as the user inserted the volumes and state of substance in the first section of the Excel Sheet (see chapter 4.2.1). Additional information is shown in form of unused capacities. This should attract the user's attention in terms of lost capacities, which do not contribute any value and result in additional costs because transporting "air" is not efficient. Furthermore, the aim is to trigger the thought of bundling transport flows if possible.

Tab. 10: Requirement of transport container options

					Number of Containers	Gross Weight per Container (in tons)	Unused Capacity (in tons)
Container Options	20ft container	Tare weight	2,5	tons	(automatic fil-in)	(automatic fil-in)	(automatic fil-in)
		Net payload	21,75	tons			
		Max. gross weight	24,25	tons			
	40ft container	Tare weight	4	tons	(automatic fil-in)	(automatic fil-in)	(automatic fil-in)
		Net payload	26,4	tons			
		Max. gross weight	30,4	tons			
	20ft tank container	Tare weight	3,5	tons	(automatic fil-in)	(automatic fil-in)	(automatic fil-in)
		Net payload	28	tons			
		Max. gross weight	31,5	tons			
		Capacity	36 000	litres			
	22ft tank container	Tare weight	4,5	tons	(automatic fil-in)	(automatic fil-in)	(automatic fil-in)
		Net payload	29	tons			
		Max. gross weight	33,5	tons			
		Capacity	36 000	litres			
	24ft tank container	Tare weight	5,5	tons	(automatic fil-in)	(automatic fil-in)	(automatic fil-in)
		Net payload	30	tons			
		Max. gross weight	35,5	tons			
		Capacity	36 000	litres			

4.3. Obstacles and Lessons Learned

The first draft of the planning guidelines were presented during the working group meeting in Usti nad labem and project partners expressed their concerns about the practical application as it is only theory-based. Aspects such as national and regulative

differences were missing and the structure of the planning guidelines was insufficient. Therefore, in the upcoming steps WP1 leader demanded for the project partners' contributions regarding those differences. The responses were consolidated and integrated in the planning guidelines. In order to create the toolbox element sufficient an Excel template was generated. Moreover, the collection of external data e.g. from Logistics Service Providers was time-intense and in some cases not successful.

In general, one major problem was that project partners do not share a common understanding of the definition "Toolbox". Participants in the beta-test expected the Toolbox to be a sophisticated and IT-based planning tool that provides a solution to plan multimodal transport. However, this does not lie within the scope of the project. The actual aim of the toolbox and the respective elements is to create awareness and make it into the decision-making process regarding transport. This in turn should trigger a modal shift and make practitioners more sensitive for CO2 emissions. In addition, the advantages of multimodal transport should be visualized and thus promoted.

Additionally, project partners could not agree mutually on a list of parameters, which should be included in the planning guidelines. More precisely, costs were stated as an important criterion to be included but due to reasons such as differing pricing models and no guarantee for transparency, costs were not included.

As the approach at the beginning of the development phase was of theoretical nature, the semi-finished planning guidelines are increasingly oriented towards a practical approach. Hereby, the feedback and contents received during the pilot activities and the second peer review (D.T2.2.4) is of major importance to fine-tune the toolbox as a whole. Instead of a stand-alone element, the planning guidelines are interrelated with the Visualization element, namely Intermodal Links Planner, and the CO2 Calculator. All of this is based on the Consulting Services, which build a framework for the application of the remaining elements. Yet, it is clear that the Toolbox cannot be a static tool that is developed once and remains the same over time. Changing regulations require changes within the Planning Guidelines.

5. Consulting Service

5.1. Initial approach

For this toolbox element, the partners wanted to develop an approach for implementing consulting services in close cooperation with chemical companies to discuss current transport patterns, existing potentials and possible actions to promote modal shift. The consulting is understood as a process, which involves the cooperation between project partners and the target group in the course of the pilot project. Main thematic input into this consulting process constitute the toolbox, which has been developed in WPT1 with focus on the different elements: 1. IT Visualisation of transport flows and transport planning, 2. Planning Guidelines, 3. CO2 footprint measurement. All partners have to be trained and have sufficient knowledge on the usage of these toolbox elements. The consulting process will take place in the framework of the three pilot project workshops and in bilateral cooperation with single companies. Project Partners must attract interest of companies to join the pilots, which can only be achieved if they firstly accept thematic competence of the project partners and secondly if they can clearly see benefits for their company in view of improved logistics and cost. Different phases of consultation process have been described: identification of target group, establishment of first contact, understanding motivation, explaining the project offer, organising group discussion, establishing bilateral cooperation and documentation of results.

5.2. Actual Approach

The consulting process of project partners in cooperation with chemical companies and logistics services providers will be implemented in the pilot projects in WPT2.

Main thematic input into this consulting process constitute the toolbox, which has been developed in WPT1 with focus on the different elements:

1. IT Visualisation of transport flows and transport planning
2. Planning Guidelines
3. CO2 footprint measurement

All partners should be trained and have sufficient knowledge on the usage of this toolbox.

The main structural framework of the consulting process is fixed by three pilot project meetings (kick-off, mid-term and final), where several companies, LSP and project partners come together to discuss about potential for modal shift, the establishment of new multimodal connections and best-practice solutions. Methodological approach and thematic focus for these meetings have to be developed to take into account the environment of cooperation and competition. Due to possibility of non-disclosure of

sensitive transport data to competing companies, these meetings might be more focused on exchange of experience and discussion of best practice. Furthermore, the initiation of horizontal cooperation – bundling of transport between different companies - is an important objective of these meetings. Logistics Service Providers have to play an important role in this process.

Deeper cooperation and consulting in between these meetings will take place in bilateral cooperation between project partners and single companies. In this framework, confidentiality of data can be better ensured.

Project Partners must attract interest of companies to join the pilots, which can only be achieved if they firstly accept thematic competence of the project partners and secondly if they can clearly see benefits for their company in view of improved logistics and cost. Cooperation with supporting structures and logistics experts should be used to attract interest of companies.

5.2.1. Consulting Process

Identification of Target Group:

- Get overview – list of companies from Chamber of Commerce
- Members of Chemical Industry Associations or Chemical Clusters / Networks
- Select relevant companies – with sufficient size and critical mass for multimodal transport

Establish Contact

- Research of contact details via website or from chamber and associations
- Identify relevant contact person – Managing Director (Decision making level) or Supply Chain Manager (Working Level)
- Get support from supporting structure (Chamber, Cluster, Network) for introduction
- Send summary of information about the project and objectives for promotion of multimodal transport
- Follow up with phone calls and personal meetings to get to know each other, possibly with participation from supporting structure to establish trust

Understanding Motivation of Companies

- Speak about current situation of companies, relevance of logistics, problems and strengths
- Discuss about experiences with multimodal transport (good and bad)
- Understand internal organisation of supply chain process, persons involved and their capacities, structures
- Get an idea about the potential for modal shift

Explaining the project offer

- Explain general project activities and objectives
- Explain possible support and added value from project (e.g. tool, pilot workshops, etc.)
- Discuss potential interest and contribution from company
- Ensure confidentiality of information

Organising group discussion

- Organisation of three pilot project workshops (kick-off, mid-term, final)
- Invite several companies to present their experiences (good practice) of multimodal transport
- Invite LSP to present their current activities and mid-term strategies for establishment of new multimodal connections
- Initiate debate about relevant transport destinations with high volumes that could be interesting for the modal shift from road to multimodal or bundling of transport – horizontal cooperation
- Present interesting information about relevant framework condition, e.g. funding, supporting policies etc

Establishing Bilateral Cooperation

- Follow up from group discussion to identify relevant road transports which could be shifted to multimodal
- Identify necessary steps, which need to be undertaken for the planning
- Offer support to facilitate the process

Documentation of Results

- Document modal shift, which has been initiated in the course of the pilot
- Check confidentiality – anonymise data
- Describe best-practice solutions – success stories

5.2.2. Additional Explanation

What is the objective of the consultation process?

The main objective of the pilot project is the identification of modal shift potential in single chemical companies and the facilitating support for the real implementation of this modal shift in the lifetime of the project duration.

How is the moderation consultation process implemented? How are the developed tools used?

For this purpose the project partners will personally meet with representatives from a single company in bilateral discussions to discuss their current status of logistics operations. In this discussion the partners will explain the objectives of the ChemMultimodal project and present the advantages and requirements of multimodal transport in general. The discussion with the company will continue to identify specific transport connections for inflow and outflow, which are currently transported on the road and which have a potential for modal shift. The requirements for these transport are for instance large transport distance, sufficient volumes, transport times, product related requirement such as heating, cleaning etc. The toolbox element Planning Guidelines is used by the partners to acquire the relevant knowledge for this discussion with the companies beforehand. The Planning Guidelines are not given as stand-alone product for self-use to the company. The discussion process with the single company, which is coordinated by the project partner is supported by the participation of a senior logistic expert, which has a long-term experience in the chemical industry supply chain management. In many cases the expert is connected to the chemical logistics associations or clusters in the region. His thematic authority and expertise is very important to achieve acceptance for this moderation process and also to better understand the requirements of the company and develop recommendations for the individual case.

After the identification of transport connections, which have a potential for multimodal transport. The project partner will use the IT Tool for visualisation (e.g. intermodal links or railway tools) to look for existing regular multimodal connections, which are suitable to the requirements of the company. This visualisation tool provides information on the relevant logistic services provider that regularly organises transports from one terminal to another, which are located close to the source and target destination of the particular transport. The time schedule and duration of transport is included in this tool

and gives the company a better understanding if this connection is suitable to their needs. At the end of the discussion with the companies the project partners will recommend to the company to get in contact with the respective logistics service provider in order to obtain a detailed offer for the multimodal transport of its goods. If there are personal contacts to the LSP, the project partners might also facilitate contact between company and LSP.

After this recommendation it is the only responsibility of the company and LSP to negotiate a possible cooperation and terms of contracts. The project partners are not involved in this process. The project partners will keep track on the identified connections and keep in contact with the company to ask if this recommended modal shift has actually taken place. The results of this modal shift e.g. tonnage and distance will be documented. With the help of the toolbox element for the calculation of CO2 emissions, the partners will calculate reduction of greenhouse gas emissions.

Who is the target groups and are there any costs related?

The target group of the above describe process are chemical companies. The project partners don't charge any costs to the companies as this forms part of the pilot project and the main role of the project partners is providing information, engaging in discussion, facilitation of cooperation and networking between companies and logistics service provider and being a neutral moderator without any own interest in the matter.

5.3. Supporting Structure and Experts

Several partners have established deeper cooperation with existing networks and structures, which can be used to support the consulting process and the implementation of the pilot projects. There are specialised working committees in the Chemical Associations, chemical clusters or logistic associations or networks, that can help to work together with the companies. The following tables describe these supporting structures and the potential form of cooperation. These structures should also be functional and sustainable after the end of the project to sustain promotion of multimodal transport in one or another way. Furthermore, several experts from the field of chemical logistics have been involved in the project, which also support the consulting process.

Austria

Name of Supporting Structure:
1. Kunststoff-Cluster 2. Logistikum Steyr
Responsible Organisation:
1. Business Upper Austria – OÖ Wirtschaftsagentur GmbH 2. RnD department of the University of Applied Sciences Upper Austria in the field of logistics
Members:
1. Companies and institutes in Austria along the whole value chain of plastics 2. Project partners of several projects e.g.: chemical park Linz
Objective:
1. Bring together manager from plastics companies, discuss challenges of plastics industry 2. Researching and striving for innovation in the area of Upper Austria in cooperation with industrial and retailing companies
Cooperation approach
1. Organizing meetings, workshops, discussion rounds, trainings, etc. 2. Cooperation in form of project work in specific topics related to transport, mobility and innovation
Timeline for the development of actions:
1. Project partner 2. Project partners
Contact Person
1. Jürgen Bleicher, juergen.bleicher@biz-up.at 2. Nadine Moritz, nadine.moritz@fh-steyr.at, or Christian Haider, phone: +43 5 0804 33267, christian.haider@fh-steyr.at
Name of Expert:
Mag. Robert Wunderl
Company:
Austrian Chamber of Commerce
Describe competences and experiences

Supporting function in updating or providing information in the field of chemical industry; Organizing workshops, conferences in the sector of hazardous goods transport
Contact Details:
Mag. Robert Wunderl, phone: +43 5 90 900 3209, Robert.Wunderl@wko.at

Hungary

Name of Supporting Structure:
Huckepack Development Working Group
Responsible Organisation:
Hungarian Association of Logistic Service Provider Centres
Members:
Logistic Service Provider Centres, LSPs, Rail Cargo
Objective:
Bring together transport planners, service providers and client companies to discuss and improve the craned trailer transport mode.
Cooperation approach
WG meets to exchange of information, consult and discuss the improvement possibilities (barrier is the high cost of the new trailers)
Timeline for the development of actions:
WC meets quarterly, presentation of the results and new implementations, discussion about further developments
Contact Person
Ajtony Koppány Bíró, Secretary General, birokoppany@gmail.com
Name of Expert:
István Gál
Company:
BI-KA Logistics Ltd.
Describe competences and experiences
Magister and Certified expert in Logistics, transport organization, warehousing, multimodality
Contact Details:

gal.istvan@bi-ka.hu

Poland

Name of Supporting Structure:
Polish Chamber of Chemical Industry - Transport and Distribution Committee
Responsible Organisation:
Polish Chamber of Chemical Industry (PIPC) is an association of chemical industry in Poland representing it's Members in relations with national and European administration and in international organizations.
Members:
Transport and distribution companies
Objective:
Promoting actions aiming at safety in transport and distribution of chemicals. Assessment of conditions and consequences of actions related to restructuring and privatization of both the transport and chemical sectors. Initiation of projects focused on the amendment of both economic and legal conditions of execution of transport and distribution tasks. Submitting formal requests to the Chamber to initiate required actions in the scope significant for transport and distribution functions in the chemical industry (for example: safety and security issues, free competition, legal regulations etc.) Cooperation with international organizations associating service providers on the transport and distribution market. Issuing opinions on legal regulations related to the problem of transport and distribution. Establishing better contacts with SPOT System. Problems related to the tanks flushing quality.
Cooperation approach
Project advice, information on practical aspects of transport, exchange of best practices.
Timeline for the development of actions:
Committee meets each semester, Project will be presented, discussion about modal shift etcs
Contact Person

Paweł Zawadzki Pawel.zawadzki@pipc.org.pl +48 790 340 010
Name of Expert:
Ewa Anna Wołynkiewicz
Company:
Brenntag Polska Sp.z o. o.
Describe competences and experiences
Experience in the field of transport and distribution of chemical goods.
Contact Details:
Ewa Wołynkiewicz ewa.wolynkiewicz@eurochemservice.pl

Italy

Name of Supporting Structure:
Federchimica – Logistic Committee
Responsible Organisation:
Italian Federation of Chemical Companies
Members:
About 70 logistic Manager from 40 chemical companies
Objective:
The main aim is to analyse the challenges of chemical logistics, finding common position on transport policies, interfacing Italian institutions in order to provide support fort transport policies, etc.
Cooperation approach
Cooperation possibilities include: stakeholders' meetings, logistics committee, W.G. on logistic themes. A common meeting between Federchimica and Assologistica (association of logistic companies) could be useful.
Timeline for the development of actions:
During the ChemMultimodal time span, Stakeholders gather every 6 months; the same periodic time schedule is foreseen for Logistic Committee.

Contact Person
Francesca Belinghieri, head of Logistic Department in Federchimica

Name of Expert:
The team includes some 70 experts. If necessary we can provide a separate list.
Company:
n.a.
Describe competences and experiences
n.a.
Contact Details:
n.a.
Name of Supporting Structure:
Consorzio IBIS – Innovative Bio-based and Sustainable products and processes
Responsible Organisation:
n.a.
Members:
AGRINEWTECH S.r.l. AGROINNOVA-Centro di Competenza per l'Innovazione in Campo Agroalimentare-UNIVERSITA' DI TORINO BRACCO IMAGING S.p.A. BRUKER ITALIA S.r.l. CAGE CHEMICALS S.r.l. CHEMESSENTIA S.r.l. GARBO S.r.l. ISAGRO S.p.A. MEMC ELECTRONIC MATERIALS S.p.A. MYBATECH S.r.l. NOVAMONT S.p.A. PO.INT.ER. S.r.l.

POLITECNICO DI TORINO PROGE FARM S.r.l. PROVINCIA DI NOVARA RADICI CHIMICA S.p.A. RESCOM S.r.l. SESTRIERE VERNICI S.r.l. UNIVERSITA' DEL PIEMONTE ORIENTALE
Objective:
The main aim is to analyse the challenges of chemical logistics, finding common position on transport policies, interfacing Italian institutions in order to provide support fort transport policies, etc.IBIS is an innovation cluster provided by public and private bodies devoted to research in scientific field, and by a number of chemical companies from Novara and other Piedmontese territories. Its aim is to sustain, encourage, coordinate and select the best innovative projects deriving from the activities developed by its associates and other companies interested to share the same issues. Environment safeguard and innovation in chemistry are the main focuses of IBIS and in general of CGREEN-Green Chemistry and Advanced Materials, the Piedmontese innovative network that IBIS contributes to manage.
Cooperation approach
IBIS' organization model is very easy and light, with no hard structure and always open to the subjects interested to enter and share the common goals.
Timeline for the development of actions:
Always open
Contact Person
Barbara Tosi, general director. direzioneibis@novarasviluppo.it
Name of Expert:
Giovanni Pieri
Company:
Self-employed
Describe competences and experiences
Former manager in important chemical companies, nowadays president of IBIS' technical-scientific committee
Contact Details:

pierig@msoft.it

Slovakia

Name of Supporting Structure:
Association of chemical and pharmaceutical industry of the Slovak republic Working Committee on Logistics and Dangerous Goods Transport
Responsible Organisation:
Association of chemical and pharmaceutical industry of the Slovak republic Association of logistic and forwarding of Slovakia
Members:
Companies of Association of chemical and pharmaceutical industry of Slovak republic Logistic service providers for chemical industry
Objective:
Working committee of logistic and DINS – cooperation base for specialists of chemical logistic Working committee for dangerous good by Logistic and forwarding association of Slovakia
Cooperation approach
Meetings and communication of logistic experts of ZCHFP SR – working group of logistic Personal contacts with managers of transport companies, conferences,
Timeline for the development of actions:
Committee meets 2 times per year and meeting of project also2 times in year Project is presented in general meetings of ZCHFP SR Top logistic conferences in Slovakia – Forum kolajovej dopravy – March -Bratislava, Horizonty zeleznicnej dopravy – September - Zilina , Speedchain Slovakia – June- Modra, Chemistry – September – Liptovsky Jan Articles in press – magazine Transport a logistika, Nebezpecny naklad, Discussion on web for transport, logistic
Contact Person
Jaroslav Cermak, Head of working group, ZCHFP SR, tel. +421 31 775 2328, jcermak@duslo.sk Coordinator of international projects ChemLog
Name of Expert:

Juraj JAGELCAK Frantisek KOMORA PKZ Miroslav MONIAK Fortischem Miroslav IVANIC Mondi SCP Peter MULIK LC Slovaktrans Ladislav FORGACH Alexander HATVANI Peter KISS Rastislav GLASA Jiri POKORNY
Company:
University of Zilina road, multimodal, marine transport, transport safety and security, PKZ Puchov forwarding, multimodal transport, transport security, Fortischem Novaky chemical logistic Mondi SCP Ruzomberok logistic, forwarding LC Slovaktrans Michalovce chemical logistic, road transport Duslo Sala multimodal transport, chemical logistic GreenChem SK multimodal transport Metrans Danubia Dunajska Streda multimodal transport ZSSK Cargo Kosice railway, multimodal transport, transport strategies TransKontajner Slovakia Kosice multimodal, railway transport
Describe competences and experiences
Juraj.jagelcak@fpedas.uniza.sk Frantisek.komora@pkz.com Miroslav.moniak@fortischem.sk Peter.mulik@lcnet.sk ladislav.forgach @duslo.sk Peter.kiss@metransdanubia.sk Rastislav.glasa@zsskcargo.sk Jiri.pokorny@trcont.sk
Contact Details:

n.a.

Czech Republic

Name of Supporting Structure:
Committee on Logistics SCHP ČR
Responsible Organisation:
SCHP ČR – member Ústí region, ZCHFP SR – has a separate committee – good cooperation
Members:
Member organizations of SCHP CR (manufacturers, distributors, carriers and operators of combined transport), representatives of the states and the Ústí nad Labem Region
Objective:
Supply chain manager from chemical companies, discuss challenges of chemical logistics, develop common positions on transport policy, exchange of experience … etc
Cooperation approach
The Committee has been operating since 1992. It has been involved in multimodal transport since 2009 in connection with the implementation of ChemLog projects. Experts' confidence is steadily growing. This year, concrete benefits are expected.
Timeline for the development of actions:
Committee meets each semester, Project is and will be presented, discussion about modal shift etc.
Contact Person
Václav Živec, Chairman of the Committee Ladislav Špaček, Secretary of the Committee Jaroslav Čermák, Chairman of the Committee ZCHFP SR Jan Sixta and Ladislav Knespl Ústí region
Name of Expert:
Prof. Jaroslava Hyršlová, Dr. Jan Chocholáč,
Company:
University Pardubice
Describe competences and experiences

Project external partner from 2016
Contact Details:
n.a.

Germany

Name of Supporting Structure:
Mention the name of the supporting structure e.g. Chemical Association Working Committee on Logistics and Dangerous Goods Transport
Responsible Organisation:
Mention responsible organisation: e.g. Chemical Association VCI Nordost
Members:
Supply Chain Managers from chemical companies: Dow Olefinverbund, BASF Schwarzheide, Infraleuna, Wacker Nünchritz, Infraleuna, Hoyer, etc.
Objective:
Describe objectives of the supporting structure e.g. bring together supply chain manager from chemical companies, discuss challenges of chemical logistics, develop common positions on transport policy, exchange of experience … etc
Cooperation approach
Describe possible cooperation possibilities for implementation of consulting process. E.g. WG facilitates contacts to chemical companies,
Timeline for the development of actions:
Committee meets each semester, Project will be presented, discussion about modal shift etcs
Contact Person
Dr. Matthias Hanisch Verband der Chemischen Industrie e.V., Landesverband Nordost Hallerstraße 6, 10587 Berlin Tel.: 030 34381625 Fax: 030 34381928 E-Mail: hanisch@nordostchemie.de www.nordostchemie.de
Name of Expert:
Wolfgang Schnabel
Company:
Independent logistic consultant
Describe competences and experiences

Long term experience in supply chain management, Dow Chemical
Contact Details:
Wolfgang.schnabel@mail.de

5.4. Target Group Chemical Companies

All partners have established first contact to chemical companies in the analysis phase and in several stakeholder meetings. The companies are the core target group for the implementation of the pilot project with the aim to shift transport from road to multimodal. The following table list companies that have been directly involved in the project so far and indicates if they are interested in the participation in the pilot or if the process of attracting their interest is in process. Furthermore, companies are listed, that have not been contacted yet, but which could be potential participants.

Austria

Company Name	Established Contact Yes / No	Contact Person
Sunpor, St. Pölten	Yes **Q1**: Interested in pilot, no interest? A1: No clear yes/no but agreed on being contacted when needed **Q2**: Attracting interest in process? A2: Participated in RSM	Clemes Pedevilla (Head of Logistics)
Transfercenter für Kunststofftechnik	Yes **Q1**: Interested in pilot, no interest? A1: No clear yes/no but agreed on being contacted when needed **Q2**: Attracting interest in process? A2: Participated in RSM	Christoph Burgstaller
OÖ Abfallverwertungs-unternehmen AG	Yes **Q1**: Interested in pilot, no interest? A1: No clear yes/no but agreed on being contacted when needed **Q2**: Attracting interest in process? A2: Participated in RSM	Ehrengruber Christian
Borealis Poleolefine	Yes	Goetzloff Christian

GmbH	**Q1**: Interested in pilot, no interest? A1: No clear yes/no but agreed on being contacted when needed **Q2**: Attracting interest in process? A2: Participated in RSM	
Energie AG Oberösterreich Umwelt Service GmbH	Yes **Q1**: Interested in pilot, no interest? A1: No clear yes/no but agreed on being contacted when needed **Q2**: Attracting interest in process? A2: Participated in RSM	Haberl Günter
EREMA Engineering Recycling Maschinen und Anlagen GmbH	Yes **Q1**: Interested in pilot, no interest? A1: No clear yes/no but agreed on being contacted when needed **Q2**: Attracting interest in process? A2: Participated in RSM	Hackl Manfred
Linz Service GmbH Abfall	Yes **Q1**: Interested in pilot, no interest? A1: No clear yes/no but agreed on being contacted when needed **Q2**: Attracting interest in process? A2: Participated in RSM	Hinterstoisser Christian
Kruschitz GmbH	Yes **Q1**: Interested in pilot, no interest? A1: No clear yes/no but agreed on being contacted when needed **Q2**: Attracting interest in process? A2: Participated in RSM	Lichtenegger Edwin
R³PC Roman Reder Rohstoffe Consulting	Yes **Q1**: Interested in pilot, no interest? A1: No clear yes/no but agreed on being contacted when needed **Q2**: Attracting interest in process? A2: Participated in RSM	Reder Roman

Innplast Kunststoffe GmbH	Yes **Q1**: Interested in pilot, no interest? A1: No clear yes/no but agreed on being contacted when needed **Q2**: Attracting interest in process? A2: Participated in RSM	Salhofer Stefan
Wind GmbH Thermoplasthandel	Yes **Q1**: Interested in pilot, no interest? A1: No clear yes/no but agreed on being contacted when needed **Q2**: Attracting interest in process? A2: Participated in RSM	Thiel Andreas
FH OÖ F&E GmbH Campus Wels	Yes **Q1**: Interested in pilot, no interest? A1: No clear yes/no but agreed on being contacted when needed **Q2**: Attracting interest in process? A2: Participated in RSM	Zitzenbacher Gernot
Greiner Packaging GmbH	no **Q1**: Interested in pilot, no interest? A1: No **Q2**: Attracting interest in process? A2: no	Waas Matthias
Banner Kunststoffwerk GmbH	no **Q1**: Interested in pilot, no interest? A1: No **Q2**: Attracting interest in process? A2: no	Massak Franz
Arvai Plastics GmbH & Co KG	no **Q1**: Interested in pilot, no interest? A1: No **Q2**: Attracting interest in process? A2: no	Arvai Stefan
ifw Kunststofftechnik	no **Q1**: Interested in pilot, no	Schloßgangl Hans Georg

GmbH	interest? A1: No **Q2**: Attracting interest in process? A2: no	
Colop Stempelerzeugung Skopek GmbH & Co KG	no **Q1**: Interested in pilot, no interest? A1: No **Q2**: Attracting interest in process? A2: no	Koschka Gerhard
Joh. Fuchs & Sohn GmbH	no **Q1**: Interested in pilot, no interest? A1: No **Q2**: Attracting interest in process? A2: no	Högn Thomas
FMV Roschker GmbH	no **Q1**: Interested in pilot, no interest? A1: No **Q2**: Attracting interest in process? A2: no	Seitweger Roman
Extend list if necessary		

Open Questions:

Do you have easy access to companies so far?

Often do not have the right contacts at companies. Access yes but the willingness to participate in the project was comparably lower at the chemical company's side as at the LSPs'.

Are they interested to join pilots with aim to modal shifts?

no clear yes/no but agreed on being informed in terms of further developments and proceedings and eventually participating; Borealis transport their goods multimodal in Europe once the transport way is more than 500/800 km depends on costs and accessibility

What are barriers?

Sunpor – participated in several projects and the added value was most of the times a minor one.

Higher costs, more complications and risks at transport organisation, customer define transport mode or won't pay more for ecological transport; national/european regulations are missing; harmonizing transport regulations on the different transport modes

What is added value to win their interest? Lower costs on multimodal transports; timetables where you are able to plan with, national/european regulations Sunpor – very engaged in the topic of safe and secure transport of chemical goods; have rail siding at their disposal

Hungary

Company Name	Established Contact Yes / No	Contact Person
Karsai Holding Székesfehérvár	Yes interested in pilot Yes Attracting interest in process Yes	Béla Karsai President
EGIS Private Co. LTD. Budapest	Yes interested in pilot Yes Attracting interest in process Yes	Zsolt Lukács Head of Transport Department
Béres Private Co. Ltd. Budapest	Yes interested in pilot Yes Attracting interest in process Yes	Mária Almási International Customer Service
Borsod Chemical Company Kazincbarcika	Yes interested in pilot Yes Attracting interest in process Yes	Erika Kissné Decsi Head of plastic logistics
Borealis Group Budapest, Szolnok	Yes interested in pilot Yes Attracting interest in process Yes	József Molnár Logistic Specialist and CSR
Open Questions:		
Do you have easy access to companies so far? Highly depends on the company-policies, basically yes, but sometimes practically impossible **Are they interested to join pilots with aim to modal shifts?** Yes **What are barriers?** Most important is the cost, second is the traceability, third is the longer transport time **What is added value to win their interest?** More economical and ecological solution possibility		

Poland

Company Name	Established Contact Yes / No	Contact Person
Name of company, Location	Y/N, interested in pilot, no interest? Attracting interest in process?	Name of Contact Person
Synthos S.A.	interested in pilot	Maciej Susik
STOCKMEIER sp. Z. o. o.	interested in pilot	Radosław Urbański
Brenntag Polska Sp. Z o. o.	interested in pilot	Ewa Wołynkiewicz
Solvadis Sp. Z o. o.	interested in pilot	Elisabeth Luerenbaum
Open Questions:		
Do you have easy access to companies so far? So we have quite easy access to companies **Are they interested to join pilots with aim to modal shifts?** They are interested in joining the project to assess future possibilities and analyze the issue **What are barriers?** Barriers are mainly the cost of transport and the time of transport **What is added value to win their interest?** Economic efficiency of transport and shortening time of delivery to the customer		

Italy

Company Name	Established Contact Yes / No	Contact Person
Name of company, Location	Y/N, interested in pilot, no interest? Attracting interest in process?	Name of Contact Person
BASF Italia, Villanova d'Asti	Y, interested in pilot	Mauro Gavi
Solvay Italia, Spinetta Marengo	Y, interested in pilot	Edoardo Vanni

Radici Chimica, Novara	Y, interested in pilot	Salvatore Figini / Cristian Zanchi
Open Questions:		
Do you have easy access to companies so far? Yes **Are they interested to join pilots with aim to modal shifts?** Those companies are interested because they understand which are the advantages of modal shift and also recognize the benefits of reducing environmental pollution (CO_2 Emissions) **What are barriers?** To be fully involved they need to know what this toolbox exactly is. **What is added value to win their interest?** In a dissemination activity, their example can gain the interest of other companies (example SMEs). Those companies also can provide volumes enough to do all the pilot test		

Slovakia

Company Name	Established Contact Yes / No	Contact Person
Name of company, Location	Y/N, interested in pilot, no interest? Attracting interest in process?	Name of Contact Person
GreenChem SK	Yes	Alexander Hatvani
Duslo Sala	Yes	Ladislav Forgach
Fortischem Novaky	Yes	Miroslav Moniak
Mondi SCP Ruzomberok	Yes	Ivanic Miroslav
Open Questions:		
Do you have easy access to companies so far? Yes **Are they interested to join pilots with aim to modal shifts?** Yes **What are barriers?** Deficit of multimodal units for continental transport, deficit of continental connections from/to Slovakia **What is added value to win their interest?**		

Efficiency of transport, problems with capacity of transport We will organised meeting of providers and companies for better cooperation and education.

Czech Republic

Company Name	Established Contact Yes / No	Contact Person
Name of company, Location	Y/N, interested in pilot, no interest? Attracting interest in process?	Name of Contact Person
UNIPETROL RPA	Y	Fabíková Markéta
Spolchemie	Y	Dospěl Jiří
Synthomer	Y	Lochmann Richard
Synthesia	Y	Pamánek Pavel
Synthos	Y	Malý Tomáš
Vodní sklo	Y	Kohout Jan
Fosfa	Y	Kouřílková Marta
Duslo	Y	Čermák Jaroslav
Open Questions:		
Do you have easy access to companies so far? Y **Are they interested to join pilots with aim to modal shifts?** Y **What are barriers?** Insufficient information on what will be verified in the pilot project. **What is added value to win their interest?** Great expectation		

Germany

Company Name	Established Contact Yes / No	Contact Person
Dow Olefinverbund GmbH	Contact established Still to be checked whether interest exist to participate in the pilot	Peter Heinke, Site Logistics Manager Schkopau

BASF Schwarzheide	Contact established Still to be checked whether interest exist to participate in the pilot	Jürgen Mattler, Operations Suppost Leader Schwarzheide
INFRALEUNA	Contact established Interest exist to participate in the pilot	Frank Sander, Logistics Manager
Open Questions:		
Do you have easy access to companies so far? Access is very easy via the German Chemical Association and direct contacts **Are they interested to join pilots with aim to modal shifts?** Some of them are, others have to be contacted again, see above **What are barriers?** Mainly the complex and international organisation of the companies **What is added value to win their interest?** Cost advantages will attract their interest in most cases		

5.5. Target Group Logistics Service Provider

All partners have established first contact to logistics service providers in the analysis phase and in several stakeholder meetings. The companies are the important stakeholders for the implementation of the pilot project with the aim to shift transport from road to multimodal. The following table lists companies that have been directly involved in the project so far and describe if they are interested in the participation in the pilot or if the process of attracting their interest is in process. Furthermore, it also lists companies, that have not been contacted yet, but which could be potential participants.

Austria

Company Name	Established Contact Yes / No	Contact Person
Dachser Chem Logistics, Hörsching	Yes 1. Interested in pilot, no interest? Depends 2. Attracting interest in process? Yes	Andreas Hofer (Head of Hazardous Goods Transport)
Duvenbeck, Graz/Steyr	Yes	Norbert Joichl (General

(Forwarded to Christian Rosenberger)	1. Not relevant as no chemical goods transport is executed 2. Interested and active in multimodal	Manager) Christian Rosenberger (Head of Sales CEE)
Eurotrans Speditionsgesellschaft m.b.H., Linz	Yes 1. Yes 2. Yes	Josefine (Guggi) Deiser (General Manager)
Gartner KG, Edt bei Lambach	Yes 1. Depends on the type and needed effort to participate in pilot 2. Yes	Jochen Weber (Head of Intermodal Transport Department)
Gebrüder Weiss, Hörsching/Vienna	Yes 1. Refusal – no time/resources 2. No	Walter Dolezal (General Manager)
Kühne + Nagel	Yes 1. Depends – needs to be discusses within the company 2. Yes	Gernot Leitner (Branch/office Manager)
Lugmair Handels- und Transportgesellschaft m.b.H., Roitham	Yes 1. Depends 2. Yes	Walter Pimminger (General Manager)
Petschl Transporte, Perg	Yes 1. No, because minor share of multimodal transport 2. No	Christian Spendel (General Manager)
Quehenberger, Enns	Yes, 1. Yes, but no huge volumes of hazardous goods transport 2. Yes, stay informed	Josef Berner (Branch/Office Manager)
Säxinger, Vienna	Yes but not personal (face to face) 1. Depends 2. Yes	Rudolf Hach (Head of Hazardous Goods Transport)
DB Schenker, Hörsching	Yes via phone	Thomas Ziegler

	1. Depends 2. Yes	(Branch/Office Manager)
Schildecker Transport GmbH, Pichelsdorf (Lower Austria)	Yes via phone 1. No because too little distance 2. No	Schildecker Edwin (CEO)
Schneckenreither Gruppe, Ansfelden	Yes 1. No 2. No	Alfred Schneckenreither (CEO)
Alessandro Billitz Nachfolger Gesellschaft m.b.H., Gallbrunn	Via Mail – no response	Gerhard Niederleitner (Head of Hazardous Goods)
CTS/CTE, Container Terminal Salzburg/Enns	Yes 1. Yes 2. Yes	Otto Hawlicek (General Manager)
Hoyer, Vienna	Via Phone 1. No available capacities at the time of contact	Wolfgang Eidenberger (General Manager)
Silo Maierhofer, Loosdorf	Via Mail – no response	Otto Putz (General Manager)
LKW Walter, Wiener Neustadt	Not forwarded to responsible person – no hazardous goods transport	Wolfgang Mayerhofer-Sebera (Head of Staff Training)
Rail Cargo Austria	No response	Franz Menigat-Pickl (Operational Manager BU Mineral Oil, Chemicals)
Montan Spedition, Krems	No hazardous/chemical goods transport	Barbara Glauninger

Open Questions:

Do you have easy access to companies so far?

Yes, via phone it was easy to figure out the responsible person.

Are they interested to join pilots with aim to modal shifts?

Some of them are interested but in many cases it depends on the dimensions of effort, resources etc. required of the piloting projects.

What are barriers?

Required resources and visibility of the added value by participating

What is added value to win their interest?

This cannot be generalized as it has to be differed between small, medium and large enterprises. Smaller ones may find their added value in getting access to a broader network and putting their amounts of freight on the same block train by cooperating with large LSPs. Whereas the advantage for large companies is not that obvious in my opinion – but I am happy to be convinced by other opinions.

Hungary

Company Name	Established Contact Yes / No	Contact Person
BI-KA Logistic Ltd.	Yes Yes, interested in pilot Yes, attracting interest in process	István Gál
Eurosped Private Co. Ltd.	Yes Yes, interested in pilot Yes, attracting interest in process	Tibor Szekendi
DB Schenker	Yes Yes, interested in pilot Yes, attracting interest in process	Dr. Kristóf Kopp
Kuehne & Nagel	Yes Yes, interested in pilot Yes, attracting interest in process	István Kétszery
Plimsoll Ltd.	Yes Yes, interested in pilot Yes, attracting interest in process	András Kiss
BI-KA Terminal Szolnok		
Budapest Intermodal Logistic Centre		
METRANS terminal Budapest		
Dunaújváros Terminal		

Open Questions:
Do you have easy access to companies so far? Yes **Are they interested to join pilots with aim to modal shifts?** Yes, definitely **What are barriers?** Capacity of terminals, water level in Danube (for inland waterway), missing of complex tool to have arguments to companies **What is added value to win their interest?** Consultation, training, providing argumentation (based on facts concerning cost, timing, security)

Poland

Company Name	Established Contact Yes / No	Contact Person
Auto ZAK sp. Z o. o.	interested in pilot	Piotr Greoger
Savino Del Bene	interested in pilot	Emil Piątek
PCC Rokita SA	interested in pilot	Dariusz Tomanik
Open Questions:		
Do you have easy access to companies so far? Yes by Transport and Distribution Committee **Are they interested to join pilots with aim to modal shifts?** Yes **What are barriers?** Focus on intermodal transport connected with sea transport **What is added value to win their interest?** Client portfolio rise		

Italy

Company Name	Established Contact Yes / No	Contact Person
Name of company, Location	Y/N, interested in pilot, no interest?	Name of Contact Person

	Attracting interest in process?	
Bertschi, Busto Arsizio	Y, interested in pilot	Lorenzo Bertolini
DB Cargo Italy Desio(MI) – Domodossola (VB)	Y, interested in pilot	Fabio Ungari
CEMAT	Y, maybe. They are interested especially in the CO_2 reduction	Marco Cippelletti
Mercitalia Rail	Y, interested in pilot even if so far this railway operator doesn't provide road services.	Osvaldo Bagnasco
Move Intermodal Novara	Y, interested in pilot	Laura Fortina
Open Questions:		
Do you have easy access to companies so far? Yes **Are they interested to join pilots with aim to modal shifts?** They are interested to join pilot because their business is intermodal/rail transport **What are barriers?** Costs is a sensible issue: they consider this item a proprietary info, that could not be shared with others. **These companies also do not use any tool for choosing multimodality** **What is added value to win their interest?** LSP are interested in a dissemination phase of multimodality involving SMEs		

Slovakia

Company Name	Established Contact Yes / No	Contact Person
Name of company, Location	Y/N, interested in pilot, no interest? Attracting interest in process?	Name of Contact Person
Canil SK Bratislava	Yes	Peter Burian
SPaP Bratislava	Yes	Stanislav Blasko
RCO Slovakia Bratislava	Yes	Adam Gastan, Peter Mikudik

Metrans Danubia	Yes	Peter Kiss, Milos Mervart
Open Questions:		
Do you have easy access to companies so far? Yes **Are they interested to join pilots with aim to modal shifts?** Yes **What are barriers?** System of financial help for new multimodal concepts isn´t effective. **What is added value to win their interest?** Services for new customer, problem with deficit of drivers, problems of drivers in western Europe		

Germany

Company Name	Established Contact Yes / No	Contact Person
HOYER	Contact established Interested to participate in the pilot	Jörg Heilmann, Operations Leader Terminal Schkopau
Bertschi	Contact established Interested to participate in the pilot	Markus Bilk, Business Development Manager
HUPAC	Contact to be established	Grissone
Open Questions:		
Do you have easy access to companies so far? Access is easy via the German Chemical Association and via direct contacts **Are they interested to join pilots with aim to modal shifts?** Typically the LSP's are more interested to join pilot projects to keep themselves up-to-date **What are barriers?** LSP's should not be "trained". They are an ideal source for information exchange **What is added value to win their interest?** Cost advantages and new connections for multimodal transport through new technologies or approaches		

5.6. Partner Feedback Consulting Service

Country	How should consulting and cooperation process be organised taking into account your framework condition?
Austria	First of all, smaller meetings among LSPs and chemical companies → horizontal, but this is also difficult due to fierce competition among some LSPs Secondly, meetings among chemical companies in order to figure out the volumes transported and those volumes for potential modal shift Finally get those (chemical companies and LSPs) who are really willing to work together on a table and discuss cooperation on routes, volumes etc. This is just an idea I came across while filling in this document.
Hungary	Starting with kick-off meeting (larger), then frequent bilateral or smaller group meetings, larger evaluation and development meetings very six months.
Poland	e.g. larger meetings, bilateral cooperation ????
Italy	In consideration of our framework conditions, we think the consulting structures above indicated may help a lot to increase the awareness in chemical SMEs about the positive issues related to multimodality, also taking in count that SMEs represent the largest majority of Italian companies (~80%). So, first of all, meetings should be organized, there to invite selected SMEs, focussing on real transport problems affecting transportation of chemical goods, especially dangerous products. Besides the consulting structures can contribute to create a link between chemical companies and LSPs, whose dialogue may be very important to fix common and better rules for the future set-up of a modern, safe and respectful way to transport dangerous goods through Europe and abroad. Bigger companies taking part to the upcoming pilot action already use multimodality for their logistic business, and they can provide an important example of what can be done to improve the shiftment from road to rail, and the supporting structures can facilitate this path. To train managers and technicians in SMEs and to create capacity building our consulting structures can play an important role, both oriented to general and open dissemination activities and to smaller events, including bilateral meetings.

Slovakia	e.g. larger meetings, bilateral cooperation ???? Companies have interest for multimodal transport and pilot project. Priority for multimodal operators is connection to marine ports. Problem is deficit of usable multimodal units and continental connections in priority directions.
Czech Republic	3 joint meetings of organizations involved in the pilot project - each project partner organizationally ensures one. The basis will be bilateral negotiations.
Germany	Germany will organise larger meetings with companies and LSP together to exchange experience. In between these meetings bilateral cooperation with single companies will take place.

5.7. Obstacles and Lessons Learned

The main obstacles for the consultation process are:

- Insufficient knowledge and capacity of the partner to use the toolbox elements
- Problems to approach chemical companies and logistics service providers
- Missing acceptance of project partners competence by supply chain managers
- Failure to convince or motivate companies to participate in the pilots
- Problems to initiate group discussion due to competition of companies
- Barriers to establish deeper cooperation with companies to to protection of sensible information of transport data

Measures to overcome obstacles:

- Partners have to be trained on the usage of the toolbox elements
- Chemical Associations and Networks should support the establishment of contacts to companies
- Cooperation with supporting structures and logistics experts should be used to attract interest and ensure acceptance of companies.
- Added Value of project approach and toolbox has to be clearly communicated
- Moderation skills have to be supported and pilot workshops must be carefully prepared to discuss in advance challenge of competition vs. cooperation
- Ensuring protection of data from project partner, e.g. by written statement

Target-Performance Comparison:

All partners have established contacts to chemical companies and logistics service providers. There is a good cooperation with chemical associations or chemical clusters that support the consulting process. There are already existing working group or committees that can be used to discuss project content. Logistics experts with long-term experience in the chemical industry support the partners. Partners have started to prepare pilot project cooperation approach. The usage of the tools needs to be further trained in the course of the preparation and implementation of pilots.

6. CO2 Footprint

The purpose of the Deliverable was to develop a method to calculate CO2 footprint of chemical transport on different modes to demonstrate reduction of CO2 emission after the implementation of modal shift as contribution to sustainable development.

Initial approach:

"To fulfil the purpose, preliminary the analysis and description of different methods of CO2 emission calculation was conducted. The existing platforms have been identified and analysed in terms of methodology used and ability to implement for Project's goal fulfilment. At the same time the analysis of tools for CO2 emission measurement by chemical companies and LSPs have been done."

6.1. Analysis and description of different methods for CO2 calculation

To fulfil the purpose, preliminary the literature review was conducted to identify approaches and available methodology that was already developed. Then the analysis and description of different methods of CO2 emission calculation was conducted. The existing platforms have been identified and analysed in terms of methodology used and ability to implement for Project's goal fulfilment. At the same time the analysis of tools for CO2 emission measurement by chemical companies and LSPs have been done.

There are numerous EU-wide studies on calculation of GHG emissions, e.g. CEN Methodology for calculation and declaration of energy consumption and GHG emissions of transport services (freight and passengers), Greenhouse Gas (GHG) Protocol, G4 Sustainability Reporting Guidelines, TREMOVE Economic Transport and Emissions Model, Alan McKinnon Report. Developing a methodology for CO2 measuring, the distinction between two main approaches should be drawn:

- A more general calculation method, called activity-based method, which uses the average CO2 emission factor per tonne-km by transport mode, transport volume and average transport distance by transport mode.
- An energy-based approach which estimates the actual amount of work done and the energy consumed per unit of output. The 'output' of freight transport operations is generally measured by tonne-kms and energy consumption by litres of fuel or kilowatt-hours of electricity used per tonne-km and fuel/energy CO2 emission conversation factor.

The activity-based calculation method is recommended for use by chemical companies, as most of their transport operations are outsourced, they have no direct access to energy fuel consumption data. A challenging step in the approach is establishing the

most appropriate freight emission factor for each transport mode and a particular country (in accordance with the EN 16258 standard). There are broad international differences in the nature and efficiency of freight operations (i.e. the load factor, the share of empty running, the energy efficiency of the vehicle or train), particularly in the average carbon intensity of the energy source (e.g. a source of electricity for rail transport or the nature of fuel types being obligatory used by vehicles – percentage of biofuels within the fossil fuels) and in the condition of transport infrastructure. So companies should differentiate used parameters of CO2 emissions according to the country and transport modes. The energy-based calculation method is the more accurate way of CO2 estimation for logistics companies, as they have direct access to fuel consumption data. The scope of CO2 calculation methodology is limited to transport operations. The energy consumption of handling or transhipment activities is not covered.

6.2. Description of available platforms providing CO2 emissions calculators

The calculation of energy consumption and emission data of a worldwide chemical transport chain can be done with the help of Internet platforms for CO2 calculation. There are customised CO2 calculators offered by consulting companies as well as a few free-of-charge tools available on the market (Tab. 11).

Tab. 11: Selected global, free-of-charge, Internet platforms for CO2 freight calculation

CO2 calculator	Mode of transport	Energy-based approach	Activity-based approach	Extra features	Standards
Eco TransIT World[35]	- road - rail - sea - inland - air	yes	yes	Customisation is available and extra charged	EN 16258
NTMCalc Freight[36]	- road - rail - sea - air	no	yes	Advanced version with energy-based approach is charged	EN 16258
Climate care[37]	- road - sea	yes	yes	NA	NA

[35] http://www.ecotransit.org/calculation.en.html

[36] https://ntmcalc-fb.transportmeasures.org/Milan/milan.jsf

[37] https://climatecare.org/calculator/

	- air				
LOG-NET[38]	- road - rail - sea - inland - air	no	yes	NA	NA

Eco TransIT World (ETW) is one of the most popular CO2 calculators in Europe. It is an independent industry driven platform for carriers, LSPs and shippers, developed by a consortium of different companies, with the scientific support of IWE Hannover, IFEU Heidelberg and INFRAS Zurich. ETW is a free of charge application, which shows the environmental impact of freight transport for any route in the world and any transport mode. Therefore, it allows the user to analyse and compare different transport chains with each other, and to eventually choose the solution with the lowest environmental impact. The ETW application offers two levels: (a) standard for a rough estimate, and (b) extended for a more precise calculation. The extended calculation requires the input of more information on the shipment such as: freight characteristics, route characteristics and distance, vehicle size and engine type, load factor and empty trips.

For professional users, ETW offers dedicated services that allow them to calculate large number of shipments at once without manual handling effort. This business solution could be customised what is paid extra 39. ETW application and methodology behind it are applied by: DB Schenker, Gebrüder Weiss, Gefco, Greencarrier, Group7, Hamburg Süd, Hapag-Lloyd, Kühne+Nagel, Marquard & Bahls, Mediterranean Shipping Company (MSC), Austrian Railways (ÖBB), Panalpina, Posti, Rhenus Logistics, SBB, SNCF, System Alliance Europe (SAE), Trenitalia, International Union of Railways (UIC), Wim Bosman, Zufall Logistics Group, among others. There are also two chemical companies using ETW i.e. Beiersdorf and Henkel.

6.3. Description of approaches and solutions offered from LSP (best-practice)

According to the results of our survey, LSPs, especially big players, express higher interest in CO2 emission measurement from freight transport than chemical companies. To contribute to the creation of environmentally sustainable supply chains, LSPs started working on measuring, reducing and offsetting GHG emissions. Table 2 presents the list of selected LSPs operating in Central and Easter Europe and offering multimodal transport services, which calculate CO2 emission in accordance with EN 16258 standard

[38] http://sustainability.log-net.com/

[39] Annual fees for business customers are available at: http://www.ecotransit.org/masscalculation.en.html

and communicate their eco activities and strategies to the public in easily accessible CSR statements or reports. Many of them are awarded for being responsible and sustainable businesses.

Tab. 12: Selected LSPs offering multimodal transport and calculating CO2 emission

Logistics company	CO2 Calculator	User	Mode of transport	Standards
DB Schenker	Eco TransIT World[40]	- shipper - LSP	- road - rail - sea - air	EN 16258
Kühne + Nagel	K+N Global Seafreight Carbon Calculator based on Eco TransIT World[41]	- shipper - LSP	- road - rail - sea - inland - air	EN 16258
Dachser	LogEC	- shipper - LSP	- road - rail - sea - air	DIN EN 16258 French Decret 1336
DHL	DHL Carbon Calculator[42]	- shipper - LSP	- sea - air - road - rail	EN 16258 GHG Protocol
GEFCO	Eco TransIT World	- shipper - LSP	- road - air - sea - rail	EN 16258
Panalpina	Eco TransIT World	- shipper - LSP	- air - sea - rail - road	EN 16258
P&O Ferrymasters	CO2 Converter[43]	- shipper - LSP	- road - rail	NA

[40] http://www.dbschenker.pl/log-pl-en/start/responsible-business/ekoschenkerchannel/ecocalculator.html
[41] https://www.kn-portal.com/seafreight/seafreight_overview/environment/calculator/
[42] http://www.dhl.com/en/about_us/green_solutions/carboncalculator.html
[43] http://www.poferrymasters.com/about-us/the-environment/co2-emission-calculator

			- sea - air	
Trenitalia	Eco TransIT World	- shipper - LSP	- rail - road	EN 16258

6.4. Status of CO2 emission measurement by chemical companies

According to the results of the empirical market research conducted in the first phase of the ChemMultimodal project, managers representing chemical companies in the region do not measure CO2 emission in transport. Among surveyed companies in the region none of them stated a frequent use of CO2 calculator – only one German company declared usage of EcoTransitWorld.

Lack or minor interest in CO2 emission from transport activities measurement is mainly caused by its inconsiderable proportion in total CO2 emission of chemical companies. Additionally within the frequently underlined explanations of the reasons for such a situation respondents pointed that they did not have proper equipment, they already paid for the emissions or it was not their responsibility to measure CO2 footprint.

However statements of the chemical companies though, show potential for future use of CO2 calculators as importance of emissions will increase.

Although according to Directive 2014/95/EU (Article 19a): „Large undertakings which are public-interest entities exceeding on their balance sheet dates the criterion of the average number of 500 employees during the financial year shall include in the management report a non-financial statement containing information to the extent necessary for an understanding of the undertaking's development, performance, position and impact of its activity, relating to, as a minimum, environmental, social and employee matters, respect for human rights, anti-corruption and bribery matters (…)"

CO2 emissions caused by chemical companies transport activities are also influenced by the ability to meet the requirements and assumptions of corporate social responsibility. This may be an additional incentive to increase interest in the need for CO2 measurement and the use of appropriate emission calculators.

6.5. ChemMultimodal CO2 Emission Calculator

The calculation method of CO2 emissions should be useful both for chemical companies and logistics operators and provide the one-click calculation of CO2 emissions of intermodal connections from the place of origin to the cargo destination with possibility to define freight characteristics. The method recommended for ChemMultimodal project covers following factors:

- freight characteristics (the weight of goods or number of containers),

- route characteristics (transport distance from point of origin to destination, postal code, railway stations including transit stations, port, etc.)
- transport modes with predefined average CO2-emission factor per tonne-km per transport mode.

It should be mentioned that typically the road and rail distances are different. In some cases the difference could be significant (e.g. a mulitmodal container from Leipzig – DE to East Europe is often sent 500 km westwards to Duisburg first, only then eastwards because Duisburg is the location in Germany where most of the eastbound traffic is bundled).

ChemMultimodal CO2 emission calculator was developed based on McKinnon methodology44. It represents activity-based approach for CO2 emission calculation. According to this source the average emission factors for wide range of transport activities of the chemical industry are presented on Table 10.

Tab. 13: Average emission factors for wide range of transport activities of the chemical industry[45]

Transport mode	g CO2 / tonne-km
Road	62
Rail	22
Barge	31
Short sea	16
Intermodal road/rail	26
Intermodal road/barge	34
Intermodal road/short sea	21
Deep-sea container	8
Deep-sea tanker	5
Pipeline	5
Air-freight	602

[44] A. McKinnon, M. Piecyk, Measuring and Managing CO2 Emissions of European Chemical Transport, Logistics Research Centre Heriot-Watt University EDINBURGH, UK, 2011.

[45] A. McKinnon, M. Piecyk, Measuring and Managing CO2 Emissions of European Chemical Transport, Logistics Research Centre Heriot-Watt University EDINBURGH, UK, 2011, p. 22.

The data presented in table 13 is based on the following assumptions:

- Road – the average load factor of 80% of the maximum vehicle payload and 25% of empty running
- Rail – an extrapolation of a range of emission factors reported by reliable sources across Europe[46] + the average split between diesel and electric haulage + the average carbon intensity of the electrical power source + the average energy efficiency of the locomotive + assumptions about average train load factors
- Inland waterways – the estimates taking into account different waterway conditions (upstream, downstream or canal) and vessel sizes
- Maritime – based on data from IMO divided into short-sea, deep-sea container, and deep-sea tanker
- Intermodal – as routing is often unknown and hence the distance split between the modes, and the road share of total distance varies, thus the assumption of average road feeder distance is 10%
- Airfreight – the average of the two long haul emission factors of WRI/WBCSD and NTM

The goal for ChemMultimodal CO2 calculator is to estimate CO2 emissions in a simple, fast, and easy way to convince chemical and logistics companies to shift road transport to multimodal one.

ChemMultimodal CO2 calculator was developed based on activity-based method. It allows estimating chemical and logistics companies CO2 emissions from transport chain in an easy way. The value of CO2 emissions is approximate as it is based on average emission factors recommended by McKinnon (which do not correspond with EN 16258) described above.

To calculate the exact value of CO2 emissions chemical company should determine:

- The load factor.
- The share of empty running.
- The energy efficiency of the vehicle, train or vessel.
- The carbon intensity of the energy source.

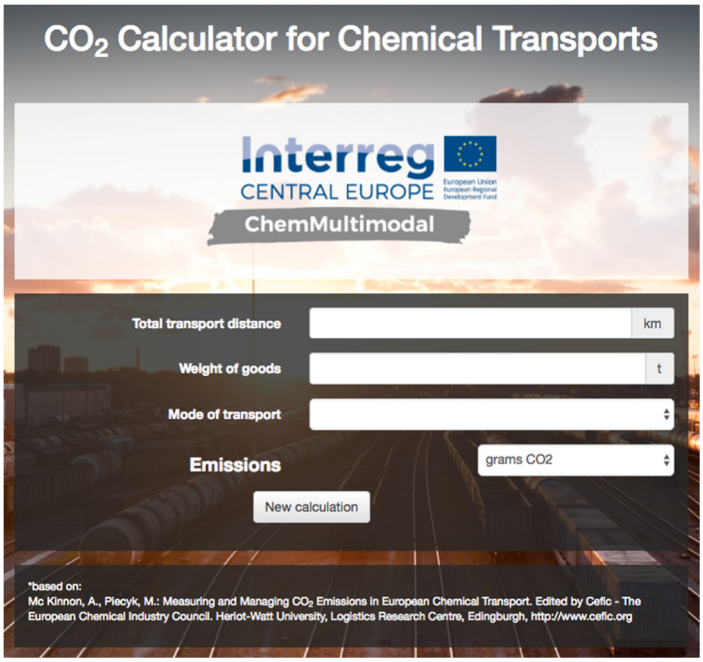
The design of ChemMultimodal CO2 emission calculator is shown on Figure 4 and it can be found at: https://ifsl50.mb.uni-magdeburg.de/chemmultimodal/

[46] *ADEME, NTM, AEA Technology, DEFRA, INFRAS, TRENDS, Tremove, IFEU, McKinnon/EWS*

Fig. 6: ChemMultimodal CO2 emission calculator

- General Information
  - All data and calculations are based on the average emission data calculated by McKinnon.

Fig. 7: Mask CO2 Calculator



- Total transport distance

User should insert the total transport distance from the shipper to the destination in kilometres. For multimodal connections there is a possibility to use Intermodal Links (https://intermodallinks.com/) to calculate the distance.

- Weight of goods

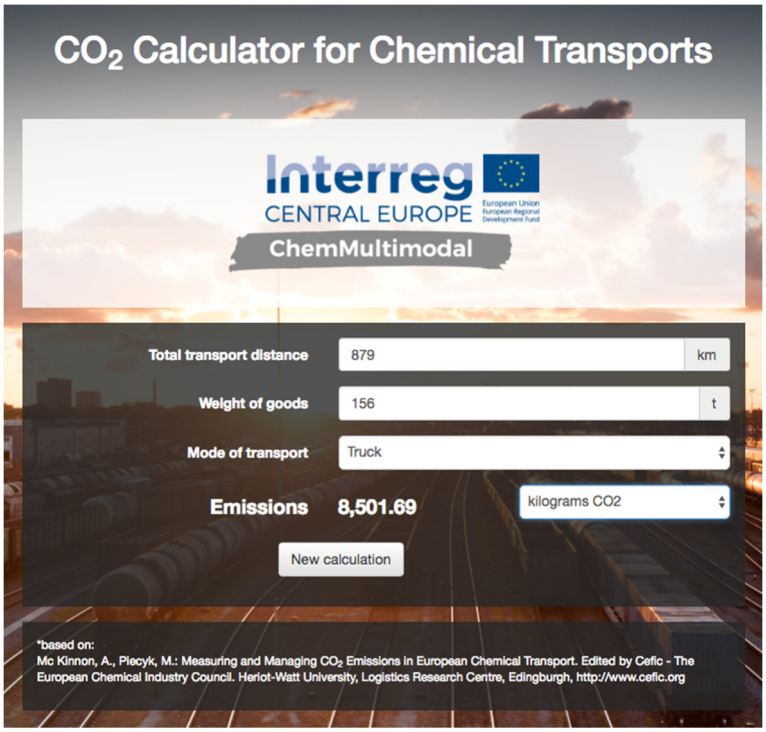
User should insert the total gross weight of all transported goods in tons.

- Mode of transport

The next step is to select the mode of transport from the list:

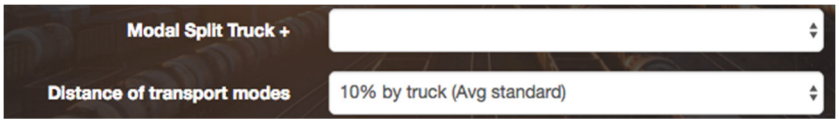
  - If one selects an unimodal transport, the CO2-emissions will be calculated immediately:

Fig. 8: Exemplary use of CO2 Calculator



- If one selects “Modal Split (Truck + …)”, new input field are shown: “Modal Split Truck +” and “Distance of transport modes”:

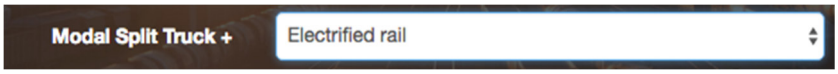
Fig. 9: Modal Split CO2 Calculator



- Modal Split Truck +

Next, user selects the second transport mode beside truck:

Fig. 10: Modal split truck + other transport mode



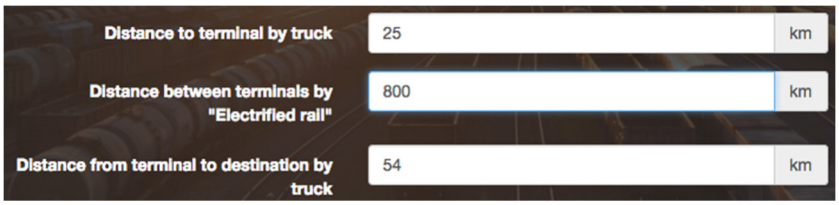
- Distance of transport modes

There is a possibility to choose fixed average values (5%, 10%, 15%, 20% of the total distance by truck):

Fig. 11: Predefined % of truck transport distance in relation to total distance

Or insert exact values by choosing “custom”:

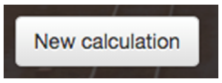
Fig. 12: Custom % of transport distance in multimodal transport chain



- New calculation

The “New calculation” button will open a new tab. This allows to compare different calculations.

Fig. 13: New Calculation Button CO2 Calculator



6.6. Obstacles and Lessons Learned

Two main methodologies were identified for CO2 emission measurement (A more general calculation method, called activity-based method and an energy-based approach which estimates the actual amount of work done and the energy consumed per unit of output). As the second method is more precise and is based on EU standards it occurred to be too difficult to implement during Project’s pilots phase and after the Project completion. After identifying major CO2 calculators on the market, the conclusion was that those calculators are very detailed and need quite some time to use them.

Measures to overcome obstacles:

ChemMultimodal calculator was developed based on activity-based method (using verified McKinnon approach and assumptions) to estimate CO2 emissions in a simple, fast, and easy way by both - chemical and logistics companies. The decision in favour of the McKinnon approach is based on the fact that time is a scarce resource and thus. It

was agreed that the calculator should allow the user to grasp the CO2 emissions caused by their transport in an easy and quick manner. Therefore, the SCG and OvGU developed the CO2 calculator in the way it is currently.

Target-Performance Comparison:

By developing a tailor made ChemMultimodal CO2 emission calculator the target of the Deliverable was met and the goal of the Project can be measured by a dedicated and sufficient tool. The calculator is available on the website for user's convenience during the project implementation and after its completion.

7. Conclusion and Future Use

During the elaboration of the toolbox, it was concluded that with respect to the sustainability of the toolbox the development of a static tool would not meet the desired output. Changing market conditions and political changes influence the action of different stakeholders being part of the market. However, the project team emphasized the development of a toolbox that includes as many standardized elements as possible. In this context, standardized means that changes among the markets do not influence the structure of the fields to be filled in in terms of Planning Guidelines, CO2 Calculator or Intermodal Links Planner. The only aspects that are changing over the years are driving regulations. With regard to loading regulations, the chance of change is probable if new vehicle and transporting concepts are developed e.g. aerodynamic trucks.

For the development of the IT Visualization element, the state of the art in terms of online planning tools was stated within Deliverable 1.1.6 IT Visualization. National partners screened the national markets for such tools and presented them during the meeting in Italy. Based on the criteria such as update frequency of transport schedules, usability, accessibility and the Intermodal Links Planner was selected as the most appropriate one and the relevant operators were contacted.

Scientific research and the inputs from the practitioners during the interview phase build the base for the Planning Guidelines. As a suitable format, an Excel spreadsheet was chosen and an interactive structure was elaborated in close cooperation between FHOÖ and OvGU. The necessary inputs were gathered and submitted to the responsible, developing project partners. The difficulty in the upcoming section might be the frequent updating of regulative changes and an adequate integration of the feedback by adjusting the toolbox.

The Consulting Service aims to build a setting that facilitates the discussion of potential modal shifts, multimodal transport in general with respective advantages and challenges. To develop a theoretical guideline, project partners were asked to share their thoughts regarding the approach of multimodal transport. Based on this the responsible partner designed a document that elaborates the aim of this toolbox element.

Existing literature consist of a broad portfolio that tackles the topic of CO2 emission and its effect on the environment. Thus, the first step was to review relevant literature and summarize most important factors. The summary refers to existing CO2 calculators, methods of measurement and companies that make use of certain CO2 calculators. The aim of the project was to create a simple and quick way to estimate transport emissions. Therefore, a new online calculator was developed by the help of OvGU. This calculator considers transport volumes, distance, transport modes and in case of combined transport the user is able to select another transport mode. In addition it is

possible to select a percentage of truck transport in relation to total distance. In case of a 500 km total transport distance in a combined context, the user is able to choose between 5, 10, 15 and 20 % executed by truck. It is also possible to customize the percentage.

To provide a more informative overview, the following table illustrates specific aspects that are important in the context of multimodal transport. Those are shown in the left column, whereas the upper row contains the single elements. Overall, the table provides an overview about what toolbox element covers which aspect linked to multimodal transport. Therefore, it can be stated that the part IT Visualization informs about Transport time (in days), location of the actors and transhipment, pre- and post-haulage and available Logistics Service Providers, which can be contacted in case of the demand for a precise offer. The same approach was applied for the Planning Guidelines, Consulting Service and CO2 Calculator.

Tab. 14: Coverage of relevant multimodal aspects and Toolbox elements

	IT Visualization	Planning Guidelines	Consulting Service	CO2 Calculator
Bundling		x	x	
Distances	x	x		x
Loading Regulations		x		
Location of actors	x	x		
Logistics Service Providers	x			
National Regulations		x		
Potential for cooperation			x	
Product Type		x		
Suitability for modal shift			x	
Transport Modes	x			x

Transport Time (in days)	x			
Volumes		x		x
CO2 Emissions				x

After the beta-test executed in form of a peer-review by the project members, the toolbox and related files are made available in the ILM Cloud. This enables the project partners to access the data 24/7 as long as an internet access is available. The implementation of the toolbox during the pilot activities expects the project partners to test the development with chemical companies and LSPs. Thereby, feedback should be gathered, which in turn serves as suggestions for improvements. Adjustment of the Toolbox is foreseen once the partners received feedback from the practitioners. The practitioner's feedback is very valuable, as those are the ones to work with the toolbox in the future. In addition, the final feedback round is carried out during the Dissemination COnference in Italy, which is named as Deliverable T2.2.4. Peer Review on Tool Fine-tuning after Pilot Testing.

The sustainability of the toolbox is partially dependent on the activities executed in WP3 Capacity Building, because the trainings carried out in the course of this work package should pave the way of further use of the toolbox by interested companies. In any case, the tool needs to be considered when elaborating a concept for the trainings anticipated in the next work package. All single elements aim to trigger a modal shift and build awareness for the possibilities of multimodal transports and hence reduce CO2 emissions, exonerate roads from trucks and resulting trucks, tackle increased transport volumes, foster cooperation among relevant market players and utilizing unused capacities.

Some further aspects, which are suggested to be taken into account in terms of the toolbox, are listed in the following section:

- For the future use of "Intermodal links" it needs to be ensured that it is easy to access and to handle by chemical companies on their own. Feedback from the pilot activities is advised to be considered.
- The CO2 calculator might need data actualization in the future due to changing parameters. Nevertheless, easy and quick use facilitates the use of the calculators and might play a key role in the decision making process during transport planning. However, this requires some changes in the market e.g. political intervention by CO2 regulations.
- Intermodal Links Planner and CO2 Calculator are standalone elements. This means that companies can use it independent of each other, whereas the Planning Guidelines and Consulting Service are anticipated to be used in combination with all

the toolbox elements. Planning guidelines and Consulting services are more or less instruments for using Intermodal Links and the CO2 calculator and serve as interdependent elements in the framework of the toolbox, no standalone character as intermodal links and the CO2 calculator is given.

7.1. Lessons Learnt

During the elaboration of the toolbox, the project team had to struggle with several challenges that might have been avoided by introducing certain measures in advance. The following section lists the major lessons learned:

- Frequent feedback from all project partners is of major importance as some of the partners are employed with chemical companies or at least related associations. Thus, they have a more practice-oriented perspective about what the market needs.
- During the elaboration of the toolbox, it is important to always keep the actual purpose of shifting transport volumes from unimodal to multimodal transport. This needs to be considered, otherwise one is endangered to lose the need for interaction of the elements out of sight.
- Before starting a development phase, a clear separation of tasks and continuous documentation of proceedings is inevitable. This requests for frequent communication between all partners. This also involves sending out information updates regarding status quo of development or next steps. A more intense communication was targeted in order to push the project forward, as the project was already delayed due to the analysis phase of the project. National and regulative differences were gathered and implemented into the Excel tool.
- Therefore, it is suggested to introduce a graph or chart, which demonstrates a clear communication flow with respective responsibilities. For example the establishment of a core team that is solely responsible for the development of the toolbox (in the case of ChemMultimodal).

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