

CONSOLIDATION: REPORT ON ANALYSIS OF MULTIMODAL TRANSPORT OF CHEMICAL GOODS FOR THE IDENTIFICATION OF MODAL SHIFT

Region: Mid-Europe

Deliverable D.T1.1.4

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Description of deliverable

Partners complete report on current situation of multimodal transports in 5 regions and 4 countries and will be consolidated:

DE: Saxony-Anhalt,

PL: Masovia + National Level,

CZ: Usti + National Level,

SK: National Level,

IT: Novara (Northern Italy - Lombardy, Piedmont, Venezia)

HU: National Level

AT: Upper Austria

Deadline: ?



1. Introduction

Nowadays the chemical industry accounts as a supplier for almost any producing industry. Thus an industry without products consisting of chemical materials is inconceivable. Typical industries, which are accounted to the customers of the chemical industry, are the automotive, electro-technical, plastics, pharma and paper industry in particular. However, due to a relatively high vertical integration among the chemical industry, it is not surprising that the most important customer, in terms of volumes, is the chemical industry itself. Before the plastics industry is able to process plastics the chemical industry needs to lay the groundwork by generating the basic substances/materials.

The comparably high vertical integration does not only contribute to the fact that the chemical industry is its most important customer but also services such as transporting and the related planning activities were executed by the chemical company. While companies in other branches already started to outsource the process of transport planning and execution, the chemical industry kept this responsibility at their duty. This was not at least due to special requirements in terms of security regarding handling and transporting chemical goods. In order to focus on the core business of generating materials for the processing industry chemical companies started to outsource logistics-related tasks. As a consequence spin-offs in form of logistics service providers (LSPs) were established. This means that an independent entity with the required expertise of hazardous goods transport and handling was found.

This consolidated report consists of the data provided by the project partners from Austria, Czech Republic, Germany, Hungary, Italy, Poland and Slovakia. As a starting point selected key performance indicators of each country are presented in form of a table in order to compare them. Among the KPIs one finds GDP, GDP growth, GDP per capita, export rate, unemployment rate and inflation rate.

When the author talks about companies both chemical companies and LSPs are considered. Otherwise chemical companies and LSPs are stated explicitly.

1.1. Description of WP 1 Approach

A pre-defined interview manual was elaborated, distributed among the project partners and translated into the national languages. The questionnaires were adapted slightly in terms of target groups, so one questionnaire targeted the chemical companies, whereas the other one was generated for the Logistics Service Provider sector. Thus, the questionnaire targeting chemical companies consist of eighteen questions and that one addressing Logistics Service Providers (LSPs) include nineteen.

In the meanwhile, potential and suitable interview partners were researched and contacted in every country/region by the partners. Within the following step selected companies were asked for an interview. Those who agreed on contributing their perspectives and opinions by answering the questions were either questioned via face-to-face method, phone call or by mail. Whereby face-to-face was the most successful option.

At the beginning of every interview the practitioner was provided with the interview document. In order to guarantee a common understanding of the terms *multimodal* and *intermodal transport* the front page consists of detailed and standardized descriptions based on the UN/ECE 2001.

1.2. KPIs of Project Partners

The Key Performance Indicators consist of Population, Gross Regional/Domestic Product growth, Gross Regional/Domestic Product per capita, Unemployment rate and Export rate of the participating countries/regions. In several cases only the overall, national values were available but in case that also



regional ones are available, those were used. The green colour signalizes the availability of regional data, whereas in Italy the value of GRP is applicable to Northern Italy. In terms of the GDP per capita the Polish value demonstrates an average of the overall country. In the region of Mazovia the GDP per capita is significantly higher and varies between 26,000 and 28,999 Euros. Based on the previously stated examples one can assume that inner national differences are present.

	Population		GRP/GDP (in Mio. €)	GRP/GDP growth	GDP per capita	Unemployment rate	Export rate
	Regional	National					
Upper Austria (AUT)	200.841	8.592.400	57.746,0 €	2,8%	40.217 €	6,1%	25,5%
Usti (CZ)	94.105	10.555.130	168.477,0 €	4,5%	15.980 €	5,0%	n.a.
Saxony-Anhalt (GER)	2.230.000	80.636.124	56.200,0 €	1,7%	56.206 €	8,8%	27,8%
HU	-	9.787.905	109.709,6 €	3,1%	11.146 €	6,8%	n.a.
Novara (IT)	28.800.000	59.797.978	915.000,0 €	n.a.	32.964 €	8,1%	n.a.
PL	-	38.563.573	416.000,0 €	3,6%	10.833 €	9,8%	n.a.
SK	-	5.432.157	78.071,0 €	3,6%	14.399 €	11,5%	87,0%

1.2.1. Modal Split

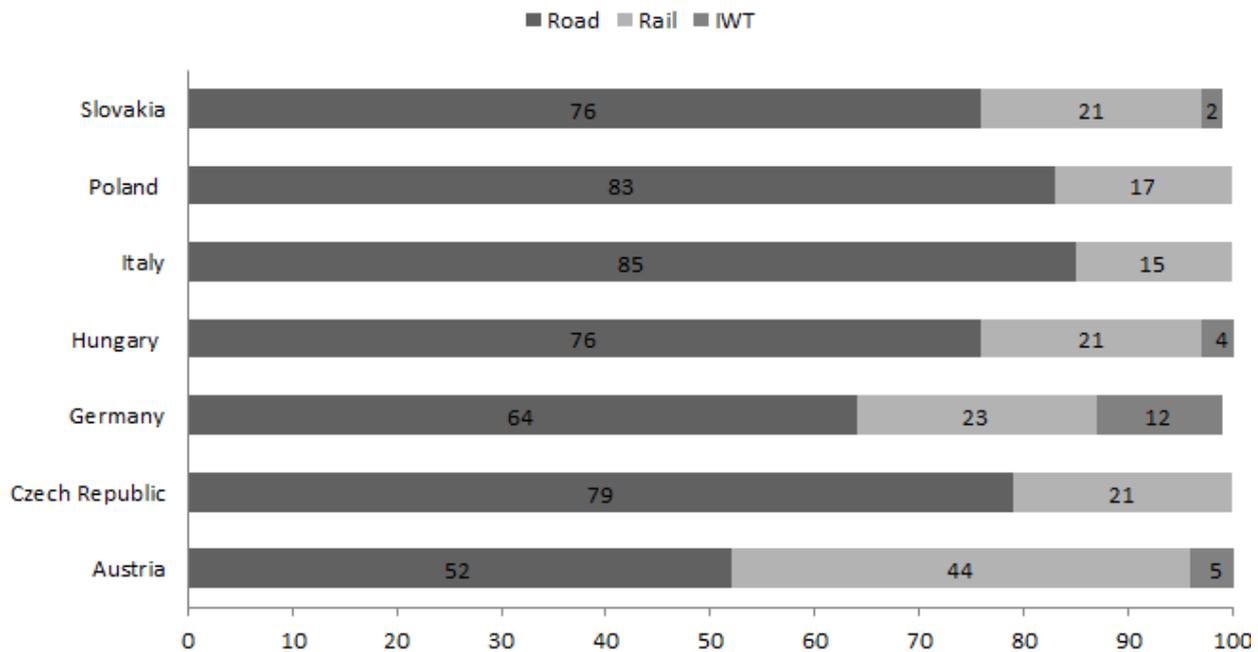
All the values mentioned in the table are retrieved from the national reports established by the project partners. The table provides an overview about the modal split in the partnering countries from the year 2015. Obviously, road transport demonstrates the highest value in every country. Interestingly in Italy the share of waterways is relatively high. Due to the favourable geographic situation at the sea, the country's harbours provide access to the sea, but also North-South transports are commonly occurring. The share of railway transports is varying between 17 and 20 per cent in five out of seven countries. In Italy the attitude of political authorities towards railway transport is comparably less supportive. Unfortunately no data was available from Poland.

	Road	Rail	(Inland) Waterway	Pipeline	Air
Upper Austria (AUT)	67,30%	17,30%	1,60%	13,70%	0,04%
CZ	76,64%	19,92%	0,77%	2,46%	0,04%
Saxony-Anhalt (GER)	78,00%	19,00%	2,00%	n.a.	n.a.
HU	69,08%	18,03%	3,29%	n.a.	n.a.
Novara (IT)	52,00%	11,00%	31,00%	5,30%	0,60%
PL	n.a.	n.a.	n.a.	n.a.	n.a.
SK	78,70%	19,80%	1,50%	n.a.	n.a.

1.2.2. Modal Split based on Ton Kilometres¹

In the following table the modal split of the project partners is visualized. In 2014 the modal split, based on ton-kilometres shows that in Poland, Italy and the Czech Republic no relevant numbers were stated, thus it is assumed that 0 % were transported by this mode of transport. A different situation is to be observed in Germany as 12 % are transported via inland waterways. In this case the Rhine has to be mentioned as the most important river allowing freight transport towards the Northern harbours. Furthermore, it becomes obvious that the share of railway transport is highest in Austria (44 %). While in Italy the road is responsible for more than 85% of the transport service, the share in Austria 52% a year 2014. Italy is closely followed by Poland with 83 %.

¹ WKO, Die österreichische Verkehrswirtschaft, p. 75



1.3. Road / Rail / Inland Waterway

This table provides a brief overview of the existing road, rail, and inland waterway (IWT) infrastructure within the partnering countries. Due to simplification the values for the entire countries were taken into account and no regional separation was carried out. Leading position in this case is assigned to Germany as it is the largest country. Interestingly the relatively high number regarding navigable kilometres is based on the Rhine-Main corridor, which allows continuous transport of freight towards the Northern sea harbours.

(in km)	Road ²		Rail ³		IWT ⁴
	Motorway	Main/national road	Electrified	Total (in operation)	Navigable (regularly used for transport)
AUT (Upper Austria)	1,719	9,997	3,537	4,826	351
CZ (Usti)	776	6,250	3,217	9,463 ⁵	687
GER (Saxony-Anhalt)	12,917	39,389	19,983	33,193	7,675
HU	1,767	6,824	2,701	7,017	1,864
IT (Novara)	6,751	19,920	11,940	16,723	1,562
PL	1,482	17,804	11,953	19,805	3,655
SK	420	3,538	1,587	3,581	172

² European Commission, 2016, p. 79

³ [UIC Synopsis, 2015](#)

⁴ European Commission, 2016, p. 49

⁵ [Scdz](#)



2. Analysis of the National/Regional Reports

Within the following chapter the results of the regional and national interviews are summarized. In total eight sub-chapters are listed, which contain the following input:

- (1) Importance of multimodal transport
- (2) Important transport routes
- (3) Potential for modal shift
- (4) Benefits and advantages
- (5) Barriers and disadvantages
- (6) Possible firm-intern improvements
- (7) Possible firm-extern improvements and
- (8) Relevance of CO₂ measurement and savings.

2.1. Importance of Multimodal Transport

The first question regarded the importance of multimodal transport for chemical companies on the one hand and for LSPs on the other hand. The aim is to collect data regarding the perception of companies acting within the hazardous goods transport. In some cases it was possible to receive an approximate share of multimodal transported goods in relation to the overall transport volumes. In order to provide a more structured overview, the main statements are listed and elaborated briefly below.

- (1) First of all, it becomes obvious that **the share of multimodal transported goods is always below 20 %**. Especially among the producing companies multimodality is not considered as an important issue, i.e. in Hungary the share multimodal transported goods is set between 1 - 3 %. One exception exists for this country and this is the fertilizer branch. In this case almost 95 % are transported via rail and inland waterways. Among the Hungarian LSPs the highest values accounted 10 %. As a comparison, the highest share of the Austrian LSPs accounts 18 %. It is important to mention that this value had been higher in previous years but due to several reasons e.g. decline in oil price, no significant advantage of railway or inland waterways, the share of multimodality decreased. First of all the competitiveness with road transport, in particular in terms of prices, decreased and certain rail tracks were shut down. Secondly, the rule of thumb claims that distances to the next terminal from the supplier and to the customers should not exceed 50 km in order to represent a sufficient alternative to unimodal transport. Distance in general plays a decisive role.
- (2) Regardless of the branch, distances matter a lot when transporting multimodal. As a consequence multimodality is considered as **efficient when transporting overseas**. The respondents among the interviewed parties shared the same opinion concerning this issue. Common answers in order to trigger a modal shift were extension of business outside the country, extension of volumes transported and favourable balance of transit time and costs. In fact, when transporting overseas, multimodal transport is inevitable.
- (3) Multimodality is considered as **efficient when sufficient volumes are achieved** - the so-called critical mass. In order to realize a competitive alternative in form of multimodal transport the



actual mass is decisive. This means that at a certain point of volumes transport on rail and/or similar sustainable modes are reasonable and a competitive advantage is achieved. However, in most of the times this happens in combination with distance. So, once the distance exceeded 300 - 500 km and specific volumes multimodal transport represented an attractive way to choose. Increased distance and volumes pose a possibility to pick multimodal instead of unimodal transport. Moreover, companies argued that already well-established intermodal connections are attractive to them as the transport can be executed in a sound way.

- (4) The **perception** of the importance of multimodal transport for hazardous goods **differs between chemical companies and LSPs**. In fact, chemical companies do not view it as important as LSPs do. However, this does not mean that chemical companies do not consider it as important but LSPs simply view it as more important. One reason is that the main business of chemical companies is producing products and progressing materials, thus their focus is primarily put on the production phases. Focusing on the core business counts as one of the main priorities of chemical companies and non-value-adding activities such as transporting and related issues are often outsourced. Whereas, on the other hand, very often the LSP's main duty is to plan and execute the transport with accordance to the customer's requirements (price, destination, transport mode, route). Besides planning and executing the transport LSPs possess the necessary know-how regarding transport modes and concepts, including multimodal transport. They are experts in this field. There was one exception in Germany, where chemical companies evaluated multimodal transport as very important but also in this case the size and export orientation of the company stand in relation to the evaluation.

- (5) Multimodality is used **more frequently when the company is considered as a big player**. Big players are defined as companies which employ more than 250 people. Among several countries it became obvious that the bigger the company the more important multimodality was perceived. A possible explanation is the bigger volumes and the increased overseas businesses.

- (6) Additionally, it has to be mentioned that the importance of multimodal transport is dependent on **the type of product**. This means that a closer look needs to be taken as the chemical industry consists of different branches such as the chemical construction materials, biofuels, fibres, fertilizers, cosmetics, plastics manufacturing and processing, paints, lubricants, pharmaceuticals etc. - only to name a few.

Surprisingly, the factors safety, security and responsible care were not mentioned in connection with the importance of multimodal transport. However, such factors play a vital role within the chemical branch. Assuming that an accident occurs with the involvement of hazardous goods, not only the transporting company but also the producing company gets

Summing up the results:

- Responsibility of transport is outsourced to the LSPs. Hence it is the the LPS's duty to perform according to the requirements, which are most of the times predetermined by the customer (= shipper).
- Perceptions of importance differ between LSPs and chemical companies due to different core objectives.
- Motivating aspects to shift:



- Bigger volumes
- Longer distances - global expansion
- Competitive advantage - pricewise
- Dependent on size of company and type of branch
- Ecological aspects are considered as a nice-to-have factor → costs are dominating decisions

2.2. Important Transport Routes

Secondly, the interviewed companies were questioned to mention major transport routes. Along with the most common answer of executing national transports, companies mentioned the routes towards and from the European harbours such as Antwerp, Rotterdam and Hamburg. Besides the main seaports others such as Gdansk (PL), Gdynia (PL), Koper (SK) and Trieste (IT) were stated. In many cases the decision in favor of a route is influenced by the fuel prices. Meaning that the lower the prices the higher the critical point of kilometers at which the decision is made pro multimodal transport. At the moment this is very often the case, so the competitiveness of multimodal transport suffers.

Austrian chemical companies stated that very often distances are too short in order to consider multimodal transport as an option. Currently, for those approx. 600 - 800 km demonstrate the break-even-point at which multimodal transport pose an alternative to road transport. Nevertheless, the majority of the chemical companies outsourced transport and correlating planning activities and as LSPs consider distances at around 500 km as a threshold to consider multimodal transport other factors such as the fuel prices, time criticality are effecting the decision. Chemical companies see their priority in price. Routes towards Eastern European countries and in particular Iran are supposed to grow and gain on importance.

For the **Czech Republic** the main destinations and trading partners at the same time are Poland, Germany and Hungary, whereas most of the transport is carried out by truck. The overall amount transported in Europe amounts around 176,500 tons of chemical goods. An approximation of at least 60,000 tons was named for modal shift. Further destinations are Scandinavian countries, Ukraine, Russia, Turkey, Italy, Switzerland, France, Spain, The Netherlands, Luxemburg but also the neighboring countries.

German chemical companies and LSPs mentioned North Sea ports (Hamburg, Amsterdam, Antwerp and Rotterdam) and North Italy including Mediterranean ports as important routes. Furthermore, Turkey, Poland and Spain are predominant routes.

In **Hungary** the transport routes are differing depending on the branch of the company. As an example the Pharma industry was mentioned and related routes are on the one hand overseas to Russia and China and on the other hand France, UK and Romania. Additionally Vietnam was stated.

For **Italian** companies (chemical ones and Logistics Service Providers) national transport routes towards the South are most relevant. Towards the islands such as Sicily and Sardinia ships are the only suitable way of transport. Furthermore Germany, Benelux, France, UK and Eastern European countries are listed among important destinations.

Polish chemical companies and LSPs execute transports towards the ARA (Amsterdam, Rotterdam, Antwerp) ports and the Polish ones such as Gdańsk, Gdynia, Świnoujście and Szczecin as an entrance point in order to reach the Polish hinterland. Additionally, overseas destinations such as Africa, Asia and South America were listed. Spain, Czech Republic, Austria, Italy, Romania, Belarus and Kazakhstan have been mentioned whereas the direct and fast connections towards Spain, Romania, Turkey and Kazakhstan are either not established or their frequency and capacity is not satisfactory.

In **Slovakia** the transport towards the neighbouring countries are too little in distance to enable multimodal transport. Whereas transports to the Eastern European countries show a potential to be



executed multimodal, however in this case the volumes are not sufficient. Same as with other countries the routes towards the Northern seaports were stated. Additionally, important starting points in form of terminals are Dunajská Streda and Kosice, whereas Melnik in the Czech Republic is an important transshipment point. Zlin, Ostrava (both in the CZ) Krems and Inzersdorf (AUT) pose valuable connecting points. LKW Walter was mentioned as an Austrian LSP offering intermodal connections via Slovakia.

2.3. Potential for modal shift

Most of the companies and LSPs agreed on the potential for modal shift either on routes to specific regions or under certain circumstances. Very often transport planning activities are executed on an operational basis, even though a strategic one is required.

In **Austria** the prerequisites for modal shift are fast, secure, timely and economic characteristics of the route, which is most favourable an already set-up intermodal connection. Furthermore a close cooperation between the actors involved in the transport chain is required to realize modal shift. Communication is an essential keyword in this affair. Especially when it comes to the

Czech practitioners address the chemical goods transport to Scandinavian states (Sweden, Finland, Norway), to Ukraine, Russia, Turkey, Italy, Switzerland, France, Spain, Netherlands, Luxemburg and to the neighboring countries (Poland, Germany and Slovakia) to be attractive for a modal shift. It is the opinion of the respondents that at least 60 000 tons of chemical goods could be transported in this way.

German chemical companies and LSPs notice that it needs a more strategic approach in order to target modal shift. An extension of already existing multimodal connections, cooperation with large shipping companies and bundling of transport flows in order to reach a critical mass are noticed as possible measures to support a modal shift. The Gotthard tunnel is perceived as an option to target multimodal transport towards Italy and Spain.

As an exception, the **Hungarian** companies see little potential for shifting. Nevertheless some companies expressed an interest in shifting when transporting to Germany and Poland. One LSP stated an intention to shift on routes destined to Northern Italy. However, shifting is only considerable when cost savings are achieved and the specificity of products is low.

For the **Italians** a strategic approach are needed and distances of more than 400 km are most of the times not a compelling criterion to transport multimodal. If it was at least one third of the overall transport volume could be shifted. However, a relatively low frequency of trains, few connections, limited numbers of stations, which are capable to handle multimodal transport efficiently, pose an obstacle. The National Agency for Rail and Transportation Safety (ANSF) are against any revision of the current regulations.

Polish companies mention that the potential for modal shifts exists at any route which is long enough, offers sufficient transport time, operate on a regular basis and offers backhaul opportunities. Additionally the strategic approach was mentioned. In particular, the following routes were stated:

- Kralupy (Czech Republic)- Valladolid | Puente san Miguel | Burgos (Spain)
- Oświęcim (Poland) | Slatina (Romania) | Adapazari (Turkey)
- Płock (Poland) - Germany | Italy
- Nowa Sarzyna (Poland) - Kazachstan
- Within Poland: Gdańsk/ Gdynia - Włocławek | Koninko

In **Slovakia** 5 - 7 % of the transport arriving from marine ports is carried multimodal. The trading volumes towards the Ukrainian areas are low but still multimodal transport would pose an option to bypass boarder waiting times. As continental intermodal growth transport from and to Nordic countries, Turkey, France and Italy are mentioned. Furthermore the following routes were stated:



- Zilina to Northern parts of Germany
- Ruzomberok to Germany, Czech Republic

2.4. Benefits and advantages of Multimodal Transport

Not only the theoretical but also the practical perspective confirms that multimodal transport offers numerous advantages, especially for industries, which handle big volumes. Practitioners from chemical companies, container terminals and LSPs provided their opinions in terms of benefits and advantages of multimodal transport systems. Once again the prerequisites of regular, strong, reliable and well-organized connections were mentioned.

In **Austria** the required infrastructure for multimodal transport is very well structured for the current volumes transported. Especially, intermodal connections which are already operating frequently e.g. towards the Northern harbours, pose a way to save time and costs at the same time. Furthermore, CO₂ related issues are of increasing importance in the future as targets were already introduced and in order to meet those also the transport sector needs to reconsider their transport strategies. So, multimodal transport systems demonstrate a way to reduce CO₂ emissions by being a sustainable way of transport. Additionally, Safety and CSR Strategy are aspects which are in particular relevant for the chemical industry.

In **Germany** the major benefits are seen in the possibility to handle big capacities and the economic transport over long distances, which start at a point of at least 300-500 kilometres. Also the distance from the shipper's site to the terminals should not exceed the 50 kilometres range. In terms of loading and operating hours, trains were stated as an easier option compared to trucks. Furthermore, the anticipated fact that road transport reaches its limits and causes congestions acts in favour of multimodal transport. A lack of drivers and the unattractiveness of the job contribute to a (forced) switch towards multimodal transport. Additionally, the aspect of CO₂ emissions was mentioned in relation with the introduced Whitepaper targets, however, those do not demonstrate a decisive factor - it is rather "nice-to-have". A very positive development was observed at the terminals in Schkopau at the Dow Valuepark and in Schwarzheide at the BASF chemical site, which are good examples of making use of such advantages.

Among the **Czech** participants a decrease in costs and shortening of the transport time were stated as main advantages. Moreover, the capacity of handling bigger volumes, which is an important benefit for the chemical industry, was ranked among the most important benefits. Also the Czech practitioners consider a relation between the CSR strategy of a company and multimodal transport as a positive one. It also emphasizes the importance of CO₂ emissions, which can be decreased by utilizing more sustainable transport systems. With reference to loading and reloading of the container, flexibility was mentioned as a benefit of transporting multimodal - "flexible reloading of the container at the terminal".

For the **Hungarian** chemical companies, terminal operator and LSPs the most important and consequently ranked first were cost savings and environmental aspects. On the other hand CSR strategy related issues are not considered as benefits. Compared to the Czech opinions, which bring CO₂ in connection with CSR strategy, the Hungarians do not necessarily see a correlation with CSR and environmental issues. The perception of reducing CO₂ emissions do not ultimately coincide with pushing the CSR strategy.

For the **Italian** practitioners the comparable higher payloads when transporting multimodal are stated as a benefit. CSR strategy and safety are beneficial factors for Italian chemical actors. Nevertheless, CO₂ emissions are not necessarily seen as a benefit out of a chemical company's perspective, but LSPs consider it as an argument pro multimodal transport. Furthermore different perspectives between chemical companies and LSPs are to be observed in terms of cost reductions and safety. Whereas chemical companies consider cost reduction as a major advantage, LSP's consider safety as one of the main advantages. The latter might have the responsibility of secure and save transport on the LPS's side as a reason.



In **Poland** the practitioners stated lower transit costs resulting over longer distances among the most relevant advantages. Also in terms of transit times, advantages can be retrieved, so quicker transits are realized. Nevertheless, also safety was stated as an advantage when transporting on rails rather than road. When it comes to environmental issues, in particular CO₂ emissions and CSR strategy, the involved LSPs are more concerned. Consequently, LSPs rate it as a main advantage in comparison to chemical companies, which do not.

In **Slovakia** once again transport costs and the efficiency of transporting bigger volumes and possibly heavier goods are considered as major benefits. Distance is a further keyword, where multimodal transport is able to demonstrate benefits in comparison with unimodal transport. Especially, when receiving from or sending chemical goods overseas multimodal transport poses a beneficial option of carriage. Furthermore, connections, which are already in place, result in time savings. Operating hours are an advantage as the regulations in terms of operating bans during holidays etc. are stricter on the road. Even though that the chemical industry is very often related to safety and security issues due to transport and handling of dangerous goods, respondents did not rate these aspects within the first three most important advantages when talking about multimodality.

Summing up the previously mentioned aspects pro multimodal transport the following main outcomes can be stated:

- Already established intermodal routes bring along advantages in terms of time and costs. Distance plays an additional vital role hereby.
- The capability to handle big volumes speaks clearly in favour of multimodal transport.
- Increasing importance of CO₂ regulations leads the actors in the chemical industry in the direction of utilizing more sustainable ways of transport.
- Costs pose an interesting benefit, especially as the reduction of such is considered as a main advantage in nearly every country/region, however, certain circumstances have to be fulfilled.

2.5. Barriers and disadvantages of Multimodal Transport

Along with the advantages practitioners were asked to evaluate certain disadvantages. Beforehand it can be stated that mainly aspects with infrastructural nature were criticized such as the existence of terminals or adequate railway connections.

The majority of the **Austrian** practitioners rated the existing intermodal infrastructure with its terminals as sufficient for the currently transported volumes. Nevertheless, the lack of railway connections influences the decision in terms of multimodal transport as it is considered as a disadvantage. As multimodal transport can pose a way to reduce costs it can also cause additional costs through less flexibility and corresponding planning activities. Thus, the effort is higher. Inner European regulations in terms of payloads are a disadvantage as this hinders a sound transport from source to destination.

German practitioners criticized the changes of railway tariffs because they are very often of short notice. This harms the competitiveness of rail transport and might cause additional costs. Another aspect mentioned was the higher complexity in planning of multimodal transport as more actors are involved and this again means additional interference points. Transit time is very often a disqualifying criterion, especially for time sensitive goods multimodal transport is not suitable. In addition higher complexity in planning of transport requires more effort. External factors such as the introduction of Gigaliner (not necessarily relevant for chemical industry), strikes, constructions, attractiveness of the job and the fact that locomotive drivers need to be aware of languages along the route, are challenges and disadvantages of multimodal transport.



In the **Czech Republic** especially the organization of multimodal transports and a potential increase in transit time are ranked among the main disadvantages. Resulting costs or even an increase in costs are also included in the main ones. Once again the missing railway connections and flexibility of transport management are stated in relation to disadvantages.

The **Hungarian** companies involved in the analyzing part of the project share a similar perspective as the Czech practitioners. Longer transit times, extended efforts in terms of organization or also discontinuity of the transport chain are stated as the main disadvantages.

In **Italy** the situation is a little different due to a difference between the Southern and the Northern part of the country. The South of Italy lacks of necessary and adequate infrastructure e.g. railway connection between the regions. Interestingly, the lack of multimodal culture/mindset was tackled. Besides providence of information regarding multimodal connections, container adaption for multimodal transport, consciousness among LSPs and chemical companies and sector's regulations are hindering the utilization of sustainable transport systems. Storage equipment and track payments are mentioned as additional disadvantages. Once again the higher efforts in planning and organizing activities lack of flexibility.

For **Polish** practitioners long and uncertain transport times and also extended planning and organizing times are considered as disadvantages of multimodal transport. Higher costs, effort and a lack of railway connections do not act in favor of multimodal transport. Furthermore, also the locations of terminals are not favorable. Regarding transit time, in most cases LSPs are not able to satisfy the needs of their customers. The reason for that is the lack of direct railway connections or the insufficiency of connection of capacity. A combination of transit time, reliability, frequency, punctuality and flexibility are needed. Regional differences in terms of the distance to the terminals also play a vital role.

The general opinion in **Slovakia** is that it is difficult to organize large amounts of modal shifts. Main reasons have been articulated in view of insufficient rail infrastructure capacity, higher costs, high planning capacity and the need to achieve a critical mass. There is also little motivation observed to act multimodal. Backhaul possibilities are very rare and the competitiveness is not high.

The most named disadvantages are summed up below:

- Lack of infrastructure → Regional differences
- Differing regulations among countries
- Little backhaul possibilities
- Higher transit times and costs
- Lack of flexibility
- Increased planning activities due to more actors involved

2.6. Possible Improvements inside Companies to Promote Modal Shift

In **Austria** the responses towards the promotion of multimodal transport are on the one hand to introduce internal activities such as internal research of shifting possibilities, awareness creation among staff members. On the other hand it is possible to participate in the extension of terminals or railway connections. But also requests for developments in this area at a political level are relevant measures.

Among the **German** participants the participation at chemical parks, so clustering of partners, is named as a potential for shifting volumes. By doing so higher volumes are generated to make multimodal transport possible. Furthermore, an extension of infrastructural issues such as container storage, equipment facilities and cleaning stations, but also railway connections. Mind changing activities and awareness



creating measures are stated as potential triggers to start rethinking their opinion of the multimodal model of transporting.

An expansion of the company, higher volumes as well as pressure from the customer's (shipper) side to trigger a modal shift were mentioned by the **Czech** practitioners. Additionally, further services such as handling and storing of chemical goods could trigger modal shift.

Mind changing activities need to be executed in **Hungary** as the major opinion is that road transport is simply comfortable. Besides, companies either have their own fleet, do not see a need in outsourcing or negotiating with a subcontractor. LSPs mentioned the possibility of cooperating in order to achieve higher volumes for multimodal transport.

In **Italy** the decision regarding the transport mode is often carried out outside of the country by a multinational chemical company. It is also said that the promotion of transporting multimodal needs to be done by the LSP. Moreover, single wagon support and the creation of certain hubs by LSPs were mentioned.

Poland names the consolidating of freights in order to reach the critical mass. This could either be attained by LPS or chemical companies working together. Furthermore, an extension and modernization of terminals and services is created. Also a changing mentality of workers and managers is required e.g. in creating an attitude towards CO₂.

The **Slovakian** practitioners mentioned an expansion regarding overseas transport and also the experience exchange of stakeholders among the supply chain. Investments into the extension of terminals operations are addressed. As an example for equipment, sidelifter on trucks to facilitate body swapping or investments in suitable wagons fleets are stated.

2.7. Possible Improvements of external framework conditions to promote modal shift

With reference to the possibility to trigger improvements via external framework conditions the practitioners from the Central European stated their perspectives and suggestions in terms of shifting.

The **Austrian** participants of the questionnaire mentioned the support of the federal state authorities or the quality increase of intermodal terminals as possibilities to facilitate modal shift. Furthermore, if modal shift takes place the existing number of terminals is not necessarily sufficient, thus an extension or increase in number is required. Cooperation along the supply chain is also considered as an external factor, which could trigger modal shift, especially in terms of reaching adequate volumes to become competitive and more efficient.

Among the **German** practitioners external aspects such as the improvement of infrastructure, single wagon support and a more harmonized construction process were stated. Additionally, the suggestion to reconsider the prioritization of passenger trains over freight trains was mentioned. Besides, the increase of track prices was criticized as those are commonly increased by short-notice.

Especially the equipment and terminal-related issues such as accessibility and services were mentioned as points for improvement by the **Czech** companies. Additionally, they see potential in making multimodal transport more attractive by providing clear price advantages. Such advantages are most desirable of monetary nature e.g. price advantages when transporting from terminals to ports or another terminal. In terms of ports and rivers a better navigability is desired by the practitioners. Also in the Czech Republic single wagon transport was mentioned.

In **Hungary** the factors of consolidating freight that has a similar source and a destination, which is either the same or nearby are mentioned in order to reach a critical mass for multimodal freight. Besides, factors such as tax reductions, extension of terminals and corresponding services, railway connections and



mind changing activities in order to create awareness for more sustainable transport systems are possibilities stated. Some companies do not see a potential to promote this type of transport externally.

In the *Italian* regions, especially the Southern part, the lack of infrastructure was addressed. Thus, as external aspects for a promotion of modal shift a qualitative increase in infrastructure is requested. There is a large consensus that their infrastructure could be improved especially regarding additional services, like storage capabilities for chemical products, etc. Additionally, the need to increase the logistic competence of people working in intermodal hubs was underlined.

The issue regarding track access charges/fees was also brought up as a possible point for improvement by the *Polish* participating companies. To promote multimodal connections and to increase the use of rail transport special discounts are offered by PKP PLK for logistics operators and forwarders, but they still expect more attractive rates. Logistics companies indicated improvement of terminals quality and increase of their capacity, number and geographical location as arguments for transport multimodality growth. They also see the need to increase awareness of multimodal solutions and sustainable transport modes advantages during theme conferences, workshops or training as well as at meetings with clients. Cooperation within logistics sector may be a trigger for extensive multimodal services development, for example for pooling small-size shipments by competitors.

Slovakian practitioners addressed similar problems as stated by the participating regions. Accessibility improvements of terminals for road transport to facilitate the transport towards the transshipment points. A decrease in operation fees when transporting multimodal and the support by authorities e.g. in form of extending intermodal infrastructure are named as possible factors. Again another starting point is embodied by the engagement of rail operators to put single loads into block trains.

In total the improvement of intermodal infrastructure and also related services such as storage and cleaning possibilities are addressed. But in particular external factors such as the support from legal state authorities is vital as the chance for changes is more likely if triggered by them. Additionally, cooperation was mentioned in the majority of the countries in order to facilitate the multimodal transport due to reaching critical mass.

2.8. Relevance of CO2 savings (Measuring CO2 footprint, calculate

Hereby the participants of the questionnaire were asked if their either measure CO2 emissions or not. So, if yes the question regarding the method of calculation was issued.

In *Austria* the perception of measuring the CO2 footprint is rather fluctuating as some companies measure it and even put it on their invoices in order to create awareness, but by now this is the minority. However, as long as no legal obligations are introduced or clear advantages become obvious in terms of measuring CO2 emissions companies will not start changing their minds. On the other hand the customer does not demand the measurement of CO2 emissions caused by transport.

The first argument for *German* chemical companies are subject to the emission trading system and their production processes are much more important when it comes to improvement of energy efficiency and CO2 reduction. The contribution of logistics to CO2 emissions in this environment is relatively small. Furthermore, there is no legal obligation to measure CO2 emissions for transport operations. Regarding the methods for calculation of CO2 footprints there are also a lot of different solutions and no clear rules. This causes an uncertainty of the obtained results. It seems to be highly likely that as long as there are no monetary or legal obligations for measuring CO2 there will be no further activities in this respect by the companies in the near future. DB Cargo offers an instrument to measure CO2 savings - EcotransIT. Also the German Chemical Industry Association VCI developed a tool for CO2 measurement "Chemie hoch 3". There is a high possibility that in the mid-term formal regulations will be introduced with strong



requirements to reduce CO₂ emissions also for the freight transport. The inclusion into the CO₂ emission trading system for the upcoming period from 2020 onwards seems not to be probable and practically.

Only one of the respondents in the *Czech Republic* (LSP) stated that they measure the CO₂ footprint of his transports by using an own methodology for the calculation. This methodology is based on technical parameters and on the manner how the used transport means are utilized. It is also based on consumed fuels. The other respondents do not measure CO₂ footprint of their transports. The CO₂ footprint is not relevant due to any relevance for the company, no obligation based on any legislation or missing methodology for CO₂ footprint measuring. Only four of the respondents confirmed that they would be interested in CO₂ savings of multimodal transport.

In *Hungary* chemical companies do not measure the CO₂ emission on transport at all, or they say it is outsourced and do not have any information. It shows that much has to be done in order to change people's mind and reach a better understanding of the importance of CSR and environmental protection. Furthermore no legal obligations are introduced, thus measuring is irrelevant. Better understanding for this issue can be observed on the LSP's side. All indicated their interest in measurement and calculation of savings, either because of their ISO 14001 certificate, or to provide an environmentally friendly fleet for their clients.

Italian major chemical companies perform calculations related to the CO₂ footprint based on software utilized and introduced by the parent company. The approaches are different as some measure the emissions for the entire productions cycle and others focus on the emissions generated during the phase of transport. Additionally, chemical companies see the responsibility of measuring the CO₂ footprint of transport among the LSP. However, also cases exist where LSP measure the emissions but do not forward it to the customer. An Environmental Benefit Calculator can be found, for instance, at <http://www.transoportdirect.info/web2/journeyplanning/FindEBCInput.aspx?&repeatingloop=y> and can help to calculate the value of an individual journey, whichever is the transport modality.

In *Poland* it occurred that for the majority of the managers it is not an important matter, and 70% of them declared that they do not measure CO₂ emission during their daily transport activities. Reasons for this are that they do not have proper equipment, they already paid for the emissions or it is not their responsibility to measure CO₂ emissions. As long as they will not see advantages or are obliged to take such activities, they might not be interested in changing their behavior in this field.

In *Slovakia* CO₂ savings are considered as less important factor. Not all the organizations engaged in the survey measure the CO₂ footprint, or if they do, it is not an important factor for making decisions. Data about CO₂ footprint may be used for marketing purposes and public relations, e.g. LKW Walter presents CO₂ savings of combined transport in its website as one of the advantages. Another possibility is using the data about CO₂ savings of combined transport within a certification of the environmental management system (ISO 14 001). All companies which do not measure CO₂ footprint of transport operations presented an interest to measure CO₂ savings of combined (multimodal) transport in the future for marketing purposes or environmental management system certifications. Companies measuring carbon footprint/carbon savings use in-house tools or measure at the level of company headquarters.

As a conclusion it can be stated that actors involved in the transport of chemical goods consider the measurement of CO₂ footprints as an issue which might have an increased relevance in the future. If it is measured some present it actively to the customer whereas others do not communicate it to third parties. However, as long as no legal obligations for measuring CO₂ footprints are implemented companies will not measure it. In terms of the methodology of measuring practitioners primarily use the tool provided by the parenting company.



3. Conclusions

During the analysis numerous statements in terms of:

- importance of multimodal transport
- related advantages and disadvantages
- potential shift
- internal and external promotion and
- relevance of CO₂ emissions were gathered.

Due to anticipated increasing transport volumes practitioners expect a potential to shift to multimodal transport. All of the participating chemical companies and LSPs estimated that the share of multimodal transport is always below 20 %, whereby the average value in the Czech Republic is around 27 %. Based on the data the overall average is approximated to be around 12.5 % within the Central European countries.

Reasons for a comparable low value of multimodal transport are too little volumes and/or little distances or the combination. By executing inner-European transport distances are either too short or insufficient connections are established. LKW Walter, an Austrian LSP, was mentioned as a best practice example.

So, as long as a critical mass is not attained multimodal transport does not pose a competitive advantage in comparison to unimodal one. Unsurprisingly, when transporting overseas the picture changes as distances and volumes are given to create multimodal transport efficient. This means that the combination is a triggering aspect, which it possible. Not to forget, higher costs are commonly mentioned in relation with multimodal transport. Shifting is only considerable when cost savings are achieved and the specificity of products is low. Modal shifts exists at any route which is long enough, offers sufficient transport time, operate on a regular basis and offers backhaul opportunities.

Furthermore, aspects such as no awareness of multimodal transport concepts are mentioned. In this specific case different perceptions between chemical companies and LSPs were identified. Especially chemical companies remarked that very often they do not even know about the possibilities to transport multimodal, whereas LSPs argued against multimodal transport based on the predetermined factors - most of all price. In the following aspects the perceptions differed as well: (1) CO₂ emission caused by transport, (2) safety during transport and (3) CSR strategy. LSPs perceive the CO₂ emissions, safety and CSR strategy as more important than chemical companies. It is assumed that this is based on the different focuses of the two actors.

The following table illustrates the predominately mentioned advantages and disadvantages:

+ capability to handle bigger volumes	Missing flexibility
+ ecologic aspects e.g. CO ₂	Increased planning activities
+ bypass congestions	Higher costs e.g. railway tariffs
+ safety and CSR aspects	Transit time
	Awareness multimodal transport possibilities

In terms of internal promotion of modal shift an increase in volumes, expansion of the company, cooperation of LSPs in transport-related areas and mind/mentality changing activities were retrieved. Further arguments included the possibility of supporting single wagon transport and long-term approaches targeting a modernization of terminals.



In terms of external promotion of modal shift federal state authorities and cooperation along the supply chain by pooling small-size shipments were stated. Furthermore price advantages, especially lower rail track tariffs, are desirable.

The following specific statements were identified:

- (1) The more exports-oriented and the bigger the company is the more important multimodal transport was rated. This is due to bigger volumes being shipped overseas.
- (2) Transport planning is predominantly perceived as an operational activity - strategic approach is needed as multimodal connections need a long-term approach to be established.
- (3) As long as no legal obligations and no standardized calculator for CO2 emissions measurements are introduced, the importance will not rise. By now only a minor part of the participants measure CO2 actively.
- (4) An increase in transport volumes and/or distances might contribute to an increase on the multimodal transport share. Otherwise horizontal cooperation and extension of infrastructural issues are considered as promoting factors.