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Co-modality

A forgotten concept?

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Abstract

Co-modality was first introduced in 2006 by the European Commission, the definition was stated as *“the efficient use of different transport modes on their own or in combination will result in an optimal and sustainable utilisation of resources”*. The authors decided to dig deeper into the true meaning of this vaguely defined concept. Stakeholders within the transport industry were asked upon their view of co-modality. A few of these knew the true definition as stated by the European Commission, while the majority interpreted it as equal to intermodality or were not even aware about the concept. These results lead the authors to try to find out if the co-modality actually is a viable and useful concept for future development within the freight transport industry.

In order to do this, the authors hypothetically suggested the inclusion of a triple bottom line model, to by some means assess and measure transport solutions. Furthermore, the authors investigated the possibility to draw parallels to philosophies of improvements, found in other industry sectors.

The results out of this hypothesis was that out of economic, environmental and social aspects included in a triple bottom line model, the economic and environmental aspects linked to freight transport were extensively covered in research and business agendas, while the social aspects showed to be less considered. This made the authors obliged to put extra attention towards social aspects, with respect to freight transport.

The suggested parallel to other philosophies of improvements, proved to reach consensus by stakeholders of the transport industry. By viewing co-modality as a philosophy of improvements, applicable to the transport industry rather than as a vaguely defined concept, the possibility of co-modality to reach further coherence as a useful way to develop transports in the future should increase.

List of definitions and concepts:

Co-modality - The efficient use of different modes on their own or in combination will result in an optimal and sustainable utilisation of resources.

Intermodal freight transport – Transportation of goods, in one and the same intermodal transport unit, by several modes of transport but without handling of the goods themselves when changing modes.

Combined transport - Intermodal transport of goods where the major part of is carried out by rail, inland waterway or sea combined with road transport where this leg is as short as possible.

Multimodal transport - Sometimes confused with combined transport, multimodal transport refers to a combination of at least two modes of transport. Regardless of mode, a multimodal transport is carried under a single contract, meaning that the designated carrier is liable for the whole carriage.

Unimodal transport - The transport of goods carried out by one mode of transport, may include one or several carriers.

Bimodal transport - Transportation which involves the sequential use of two different transport modes.

Piggyback transport - The transport of road vehicles by rail. The term was originally used only for transport of semi-trailers by rail but is expanded and now also applies to the transport of road vehicles in by rail in general.

Rolling road (Rolling motorway system) - Rail transport of complete road vehicles, using roll-on roll-off techniques, on purpose-built trains.

TEN-T (Trans European Network) – Policy launched by the European Commission, aiming to establish a single European multimodal network covering both ground-based structures and equipment to enable a safe and efficient transport system

Motorways of the sea – A part of TEN-T project, sought to develop the freight flow on sea-based routes.

Dry port – Concept where inland terminals are directly connected to seaports, comprising high transport capacity. Also enables customers to leave/pick up cargo units as if directly to a seaport itself.

Cabotage – Defined as the right of a foreign carrier to operate in a member state without having a registered office present in that country.

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1. Introduction

This chapter will introduce the purpose of the thesis and give an overview of the theoretical context that has led the authors to formulate the research questions.

1.1 Background

From the 1950s until today there has been significant development within European trade and transport, where the European Union has played a significant role in the development process. Transport has gone from being a national matter with highly regulated transport sectors to be a matter for the union with focus on deregulation and cooperation between member states. During this development the amount of ton kilometers carried by various goods increased vastly alongside with several common infrastructural projects. The influence of the European Commission has successfully been further enlarged. In 1992, the first White Paper was presented, providing guidelines for the future development of transports. The Commission has also increased the attention towards environmental concerns related to transports over the years (Kaeding, 2007).

In the midterm review of the European Commission 2001 transport White Paper (EC, 2006), the future new challenges of globalization were presented and an enlarged desire of sustainable mobility in EU was raised. A reliable transport system within the EU is stated to be a key factor for increased competitiveness of member states within EU. However, the paper clearly addresses the associated growing issue with emissions and global warming. The transport sector was accounted for 30 % of the total energy consumption of EU in 2006, with a predicted forecast that freight transport would grow with up to 50 % from 2000 to 2020.

The objective of the European Transport policy is to ensure that the transport system meets the requirements set by society from economic, social and environmental perspectives. This could be seen as an interpretation of the United Nations World Commission's expression sustainable development that was presented in 1987, and later used as a base on formulation of the theory that is called triple bottom line, which is used in many sustainable standards, see figure 1.

The triple bottom line has no standard definitions and could be used in several ways (Slaper, 2011), but could generally be implemented as follows:

- Profit - Economic development concerns the flow of money in terms of income, expenditure, taxes and business climate.
- Planet - Environmental development focuses on the viability and health of living systems on earth.

- People - Social development usually refers to improvements in both individual well-being and the overall social welfare.

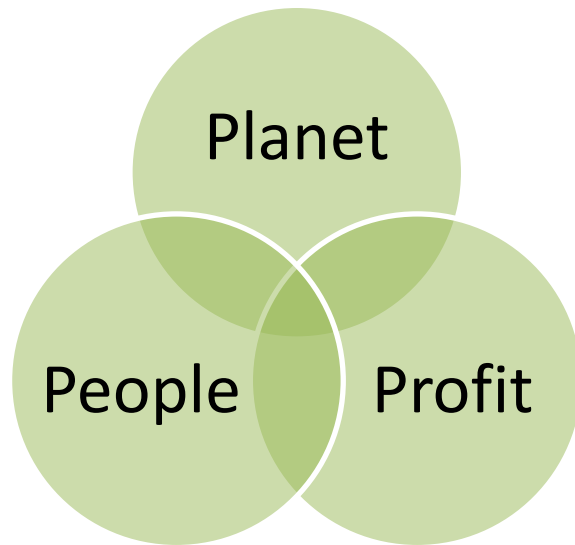


Figure 1: Triple bottom line - standard view

These three factors are important and can be seen as directional through the entire White Paper transport policy. However, the means within the policy has changed over time and before the midterm review 2006, the focus from EU policy was to promote a modal shift where transport was to be moved from road to other transport modes. In the midterm report this pure modal shift is withdrawn and the focus is instead moved towards optimization of all transport modes, in combination as well as on their own. A new concept was created to handle the future transport problems, and it was to be called co-modality.

1.1.1 Co-modality

The concept of co-modality was first introduced in 2006 by European commission (EC, 2006) and was defined as: *“the efficient use of different modes on their own or in combination will result in an optimal and sustainable utilization of resources”*. The idea of the concept could be seen as a way to raise the perspectives of transportation, the different transport modes and other factors involved with transportation. A key point is that every transport mode is necessary and needs to be evaluated and improved by itself and in combination with other transport modes.

As stated by Engström (2013), there is no strict definition of co-modality. It could rather be viewed as a philosophical perspective of transport solutions. With this said, it is important to understand that it is hard to define when a co-modal solution is reached or what it really means. However, co-modality is frequently used as a synonym to other concrete and defined transport solutions such as intermodal, multimodal and combined transports. These transport concepts are included and could be sorted under the wider term of co-modality. Parallels to co-modality could possibly be drawn from the philosophy of constant improvements, much like the Japanese industry philosophy Kaizen.

1.2 Problem area

The problem area of this thesis is connected to the energy consumption and emissions, the economic development and the social aspects of the transport sector which is a growing problem in the EU and the world. There are a lot of discussions about the negative impact derived from transport and how transports could be developed to meet the goals of sustainable development in the future. It is however important to understand that transportation is not an isolated process, disconnected from the rest of the society. The discussions about the different individual modes of transport is important, but fact remains that the transport work that is carried out, is done by various transport modes to respond to the transportation need from the society, the production systems and the consumption behavior that exists within it. From this point of view, the problem can not only be seen from individual modes in the transport sector, nor could solutions. The problem that has to be solved is the need of transports and not how the transports actually are carried out.

Co-modality could be a useful concept to improve transports to meet the requirements from society from an economic, social and environmental perspective, but also the fundamental processes that exists around transportation. However, the concept of co-modality is rather new and not that recognized in the transport sector, neither much research is conducted within the area. Today there is to a large extent focus on every transport mode by its own, instead of a wider perspective where all factors and stakeholders from a supra-national level of the entire transport system are included in the proposed solutions. The current common view of co-modal solutions as a reachable state could be seen as misleading, since the nature of the co-modality is to have constant improvements in the transport modes on their own and in combination with others. The problem is to understand how a co-modal view could be implemented and used for improvements of the overall transports from the perspectives of the triple bottom line. Compared to the structured kaizen philosophy in the industry where there always are possibilities for efficiency improvements, the concept of co-modality should be able to have an equal meaning for the sustainability development in the transport sector.

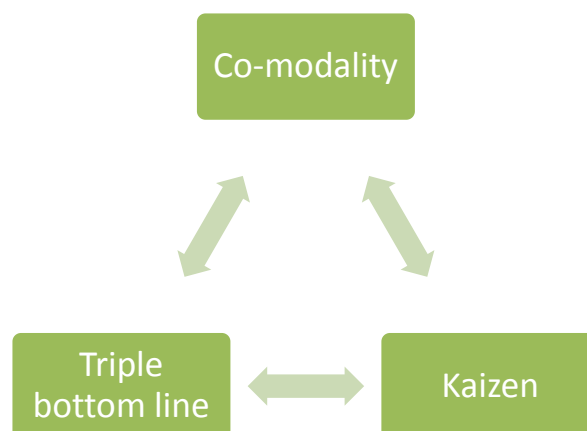


Figure 2: Framework of the thesis

1.3 Purpose

The purpose of this report is to provide further understanding of the concept of co-modality and to investigate if a triple bottom line model adapted to freight transport could be applicable to co-modality.

1.4 Research Questions

RQ1: How is co-modality interpreted by stakeholders related to the transport sector?

RQ2: Is co-modality useful for freight transport development and could it be comparable to other philosophies of improvements?

RQ3: Can co-modality be measured from a triple bottom line perspective?

1.5 Delimitations

The authors have decided to put extra focus on the People part of the triple bottom line, related to freight transport activities. This part was at an early stage found to be interesting since it is less covered in other research conducted within the fields of transport and sustainability. Even if a special focus is put to the people part, the other two parts of the triple bottom line will be assessed, since there are significant overlaps between the different parts as shown in figure 3. The authors limit to assess the chosen criteria of the triple bottom line, which is regarded as the most vital ones in relation to freight transport. There are additional aspects to social, economic and environmental development which is not mainly connected to freight transport.

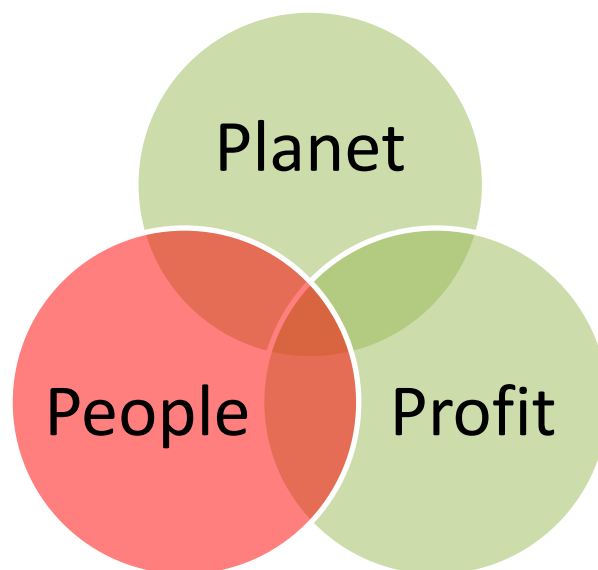
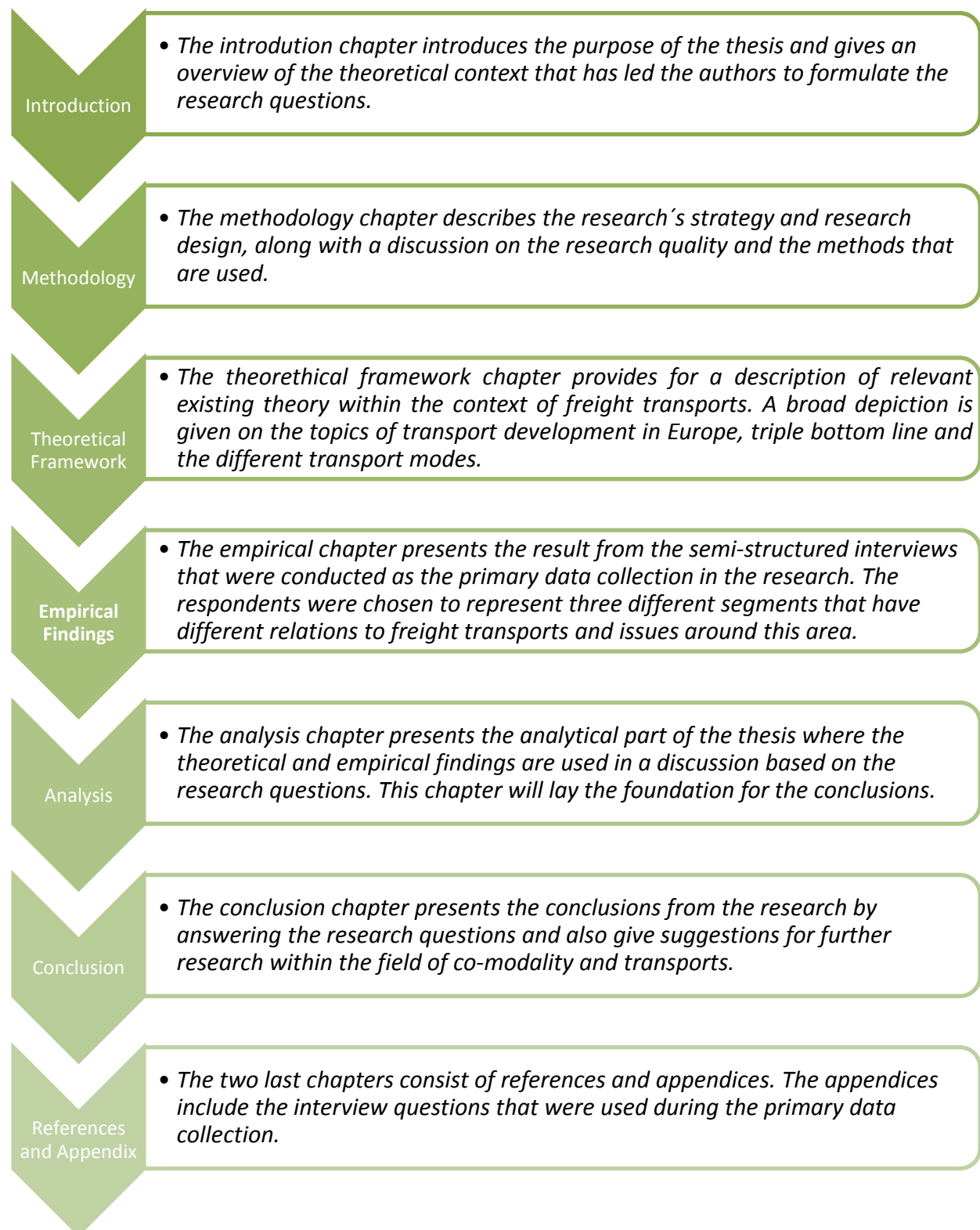


Figure 3: Triple bottom line - focus at People

The data that is presented and analyzed within the research is based and seen from an EU perspective. This delimitation was made, since the research was conducted in Sweden and from a practical point of view it was found necessary. Even if the research was conducted from an EU perspective, the core problem could be seen from a general level connected to

freight transports globally. Furthermore, the research has also deliberately left out air transport and issues related to this transport mode. This was done mostly since the transport work in ton-km of air transport represents such a small part of the total transport work (ton-km), but also since most air transport in EU is not of an intra EU transport character.

1.6 Disposition



2. Methodology

This chapter will describe the research strategy, research design, along with a discussion on the research quality and the methods that are used.

2.1 Research Strategy

The research in this thesis is based on the interpretivist research paradigm. According to Collis and Hussey (2009), the nature of interpretivism is that the social reality is not objective; instead it is highly subjective and shaped by our own perceptions. Consequently, this is the fundamental basics of this research. The focus was to get depth and quality in the data collection of the researched phenomenon and the research was conducted from an inductive approach. The observations from reality were used in the process to develop the theory about co-modality and its relation to the transport sector and the triple bottom line. In the way the research is performed, it will give new insights and a deeper understanding of the phenomenon of co-modality in the context of freight transport issues.

The interpretivist paradigm is highly associated with qualitative methods for research, the data collected tend to be rich in detail and nuance (Collis and Hussey, 2009). The data is usually not expressed by numbers, instead in words. Data integrity, which describes the research characteristics that affects errors and biases of the result, tend to be lower in interpretivist studies. However the result currency that refers to the generalizability of result tends to be higher. For all research there is always a trade-off between the data integrity and result currency (Collis and Hussey, 2009). In this research the authors are aware of the characteristics that can imply errors and biases. In contrast to this, the authors believe that it is more important to have a higher results currency when examining the complex phenomenon of co-modality and the triple bottom line in relation to the transport sector. The possibility to have a better capability to generalize the result in a contextual relevance is of greater benefit for this research and the scientific field it is conducted in.

2.2 Research Design

The research design of this study follows the structure of semi structured interviews, where the respondents were divided into three different segments. The segments were based on the respondent relation to the transports sector. The authors' idea behind this selection was to get insights about the phenomenon from various sources and thereby get a more balanced picture about the phenomenon. However it was still important that all respondents had a strong relationship to the transport sector, since the researched phenomenon is specific and could not be considered as common knowledge. Therefore a non-random sample method was used, which according to (Collis and Hussey, 2009) is useful for studies under an interpretive paradigm. The authors used a judgmental sampling where participants were selected as a result of their experience in the field of transport.

The segmentation method provided for a broad picture of the phenomenon with insights from different positions within the transport sector. However, as a result of the segmentation every segment consisted of few individuals, which could have a negative impact on the overall generalizability of the research.

2.3 Research method

The collected data in this thesis consists of primary and secondary data. The primary data consists of new data from an original source (Collis and Hussey, 2009) and was obtained by utilizing the semi-structured interview technique. Co-modality is not a straightforward phenomenon and is also generally unknown. Also, the triple bottom line is complex and allows for own perceptions and thoughts. Therefore, the semi-structured interviews allowed the researchers to adapt to the respondents by allowing additional comments and input through follow-up questions and elaboration. An additional aspect favoring the semi-structural interviews are that the intended topics will be assessed, as there is a predetermined structure to follow. As predicted, the semi-structured approach proved to be very useful during the primary data collection, since all respondents had different knowledge within the research area but also different ideas. During two of the interviews, small illustrative case studies were conducted, as a way to concretize co-modal solutions. According to Collis and Hussey (2009), this is a useful method to illustrate new and innovative ideas that has been adopted.

Drawbacks during the semi-structured interviews that the authors experienced were that the discussions in some cases ended up far away from the main issues. This affected mostly the transcribing work and the overall work load, and did not affect the final result of the research.

Secondary data is retrieved from an already existing source and is throughout the report gathered from relevant literature, scientific articles and web sites (Collis and Hussey, 2009). This data is predominantly presented in the theoretical part of the research. However this data are also referred to in other parts of the report. In this research the secondary data is mainly used to highlight existing theories and basic characteristics of the different transport modes, and could be seen in some aspects to have a relatively general character. The secondary data were retrieved both from well-known and well-used literature within the logistic field to point out fundamental features. Also more specific sources, such as scientific articles and web sites, provided depth in some areas related to freight transport and sustainable development.

2.3.1 Respondent selection

As stated in the Research method section, the respondents were divided into segments to get a balanced input from different stakeholders related to the transport sector. The three segments designed by the authors, were based on respondents from strategic, operational, and scientific level connected to transports either from the transport sector, industry or research.

2.4 Data Analysis

The data collected through semi-structured interviews were transcribed into text to allow for analysis. As all of the interviews were carried out in Swedish, a translation into English was made. The questions were sorted into categories, which enabled an easier comparison between the respondents and their answers. The chapters in the theoretical framework concerning the different transport modes, sustainability within transports and improvements methods were used to evaluate and complement the data collected in the analysis, this in order to create a red thread throughout the report. The interview questions were also sorted under Appendix 1, to provide the reader with the interview structure.

2.5 Research Quality

When conducting the research with semi-structured interviews it was important to evaluate different factors that could lead to misleading answers. First of all the “fixed” questions were evaluated by the thesis supervisors to ensure that they were formulated appropriately, and gave conditions for deeper more detailed answers. Also language problems can lead to misunderstandings. All the interviews were performed in Swedish, which was the respondents and the authors’ native language, and this reduced the risk for misunderstandings as a result of language barriers. Four of the interviews were also performed face-to-face, which minimized the risk for technical problems or disturbances and gave conditions for good conversation environment. Three of the interviews were made through phone interviews in phone conference rooms to ensure good interview conditions.

Another factor that was important to consider was the research area itself, since it is industry specific and cannot be considered as general knowledge. Therefore it was of great importance that the people interviewed had a good knowledge of the transport industry and its different processes to ensure that they could give a comprehensive insight and understanding. All the respondents had this kind of knowledge, which assures that the authors got knowledgeable answers from the respondents.

The authors also recorded the interviews to be able to listen to the answers several times to ensure that the respondents’ answers had been heard right and understood. Also during the interviews when there had been a long discussion regarding some issue, the authors ensured that the answers had been understood correctly by follow up questions.

2.5.1 Validity

Validity explains to which extent the findings in from the research actually reflect the phenomenon that is studied. High validity means that the research measures what the researcher claims that it does (Collis and Hussey, 2009). In the research the authors consider the validity to be high, this is a result of a clear and well defined research question and answer, but also as a result of the research methodology where the authors got in-depth knowledge from respondents that had good insights in the area. As stated by Collis and Hussey (2009), validity tends to be higher in an interpretivist study, since these studies get more knowledge of those involved and the meaning of the phenomenon.

2.5.2 Reliability

The reliability of a study is concerned with the possibility to repeat the study and get the same result. This is very important in positivist studies, but has in the interpretivist studies less importance or could be interpreted in a different way (Collis and Hussey, 2009). It could be seen as impossible to actually replicate the study, since the authors are a part of the process and influences the result. However, the authors have through the process explained the procedures, the interview structure and the framework for the analysis. This is the authors' interpretations of how to bring reliability to the study and to provide for possibilities to replicate the study with similar result. This is also according to Collins and Hussey (2009) a way to give authenticity to the findings in an interpretivist study.

3. Theoretical Framework

This chapter will provide a description of relevant existing theory within the context of freight transports. A broad depiction is given on the topics of transport development in Europe, triple bottom line and the different transport modes.

3.1 Transport development in Europe

To properly understand the present situation of the transport sector within Europe and how it has evolved into an aim for co-modality, it is necessary to understand how the development of trade and transport has evolved within Europe over the past 50 years.

The European Union, originating from the European Coal and Steel Community (ECSC) and the European Economic Community (EEC), has had a significant impact on trade and transport development within Europe. The European Union constitutes an advanced model of economic integration where the 28 member states have successfully transitioned into a single market where goods, capital, services and labor can move freely through the implementation of a standardized system of laws that apply in all member states. To illustrate the development of trade and transport within Europe and EU during the past 50 years until the present day, Kaeding (2007) points out four phases of intra-Europe transport development.

3.1.1. Phase I – The 30 years of deadlock (1957-1984)

Starting in 1957 and stretching almost 30 years to 1984, *the phase of deadlock* represented a time when transport were viewed upon as a national matter. Individual governments intervened heavily in transport policies with the standpoint that transport was a public service which could not be left to the private sector. The rail and road sector was highly regulated, as the European council did not enforce any practices of deregulation until the mid-1970s. The railway sector constituted a monopoly where national railway companies did not face any competition within the internal market, nor cross-border (Kaeding, 2007).

3.1.2. Phase II – Watershed (1985-1991)

The deadlock phase characterized by national interests lasted roughly until 1985, a year which is regarded as a 'watershed for supranational transport' (Kerwer and Teutsch, 2001). Due to this expression, the second phase is known as the Watershed phase. At this point of time, the amount of ton kilometers of goods carried by various transport modes had increased vastly. The general approach by European states was beginning to shift from a highly regulated, to a liberalized and deregulated transport sector. The White paper 'Completing the internal market' marked the start of this new period. This paper contained measures that had to be taken to create a singular market, primarily through abolition of barriers, harmonization of rules and increased cooperation between member states (Kaeding, 2007).

During the watershed phase, another important step was taken towards a liberalized and deregulated transport market in Europe. The Council regulation 4059/89 (1989) contained the first regulation for cabotage. The number of cabotage operations was limited to 15,000 cabotage permits annually. The permits were divided equally among the 12 member states according to their size. Moreover, in order to facilitate decisions concerning transportation policies, a proposition no longer demanded unanimity. The new policy stated, that a qualified majority (75 percent) was sufficient for a proposition to be set as law. Another important aspect with regards to the present day co-modality term, is that a sub-sectorial approach in the transportation industry was dominant during this period (Kaeding, 2007).

3.1.3. Phase III – Enlarged set of objectives (1992-2000)

The third phase was initiated by the signing of the treaty of Maastricht in 1992. This treaty shaped the modern day European Union and held the proposition for a common currency. Another vital aspect of the treaty from a transport perspective was the launching of the TEN-T project, with the purpose of integrating European infrastructure through investments and cross-border facilities.

This phase also represented a time when the European Commission acquired more influence due to an expanded role as a negotiator with regards to the Single European Act (SEA) and the Treaty of the European Union (TEU). As an effect of the increased influence, it granted more influence regarding transport safety and transport infrastructure (Kaeding, 2007).

Through the 1992 White paper ‘The future development of the common transport policy’, the European Commission increased the attention to environmental concerns. The new approach included ‘sustainable mobility for the community as a whole’ and was followed by several action programs from the Commission, focusing on common transport policies

Moreover, through these actions, the previous sub-sectorial view of transport was replaced by the integrated attention to the different transport modes and the necessity of achieving equal competitive terms for each mode. These were the first steps towards intermodality in the European Union and were boosted by the creation of the EEA (European Economic Area) in 1994. This agreement concerned the free movement of goods, capital and services within the different member states (Kaeding, 2007).

3.1.4. Phase IV – Consolidation phase (2001-2006)

The fourth phase commenced in 2001 with the submission of the White paper “European Transport Policy for 2010: Time to Decide” (EC, 2001). This paper provided guidelines for future achievements for the transport sector. The main content was the increased emphasis on intermodal transport and was mainly due to the decreasing share of railway and sea transport in contrast to the increasing share of the road transport sector. This growing imbalance was concluded to contribute to an increased congestion and failure to exploit the full potential of rail and short sea shipping (EC, 2001). To cope with these issues, several

countermeasures were proposed in the paper. To promote modal shift to intra-European short sea shipping, the Commission stated the objective to develop infrastructure, simplify regulatory framework and integrate social legislation, in other words to create a foundation for the 'motorways of the sea' concept.

Furthermore, to support intermodal transport and promote rail, sea and inland-waterway transport, the Marco Polo program was launched. The ultimate objective of this program is stated as 'to help shift international freight transport from road to short sea shipping, rail and inland waterway'.

3.1.5. Introducing co-modality (2006 -)

The white paper 'European transport policy for 2010: Time to Decide' submitted in 2001 was followed up by a mid-term review report in 2006, named 'Keep Europe moving - Sustainable mobility for our continent' (EC, 2006). This review contained an evaluation of the White paper and a follow-up on what had been achieved since its submission. The review found that the modal-shift from road towards rail and sea-transport was far from reached and also forecasted an increase in transport work by 50 percent from 2000 to 2020 (EC, 2006). It also recognized transport efficiency as an important mean to support economic growth and employment, thereby proving a connection to the Lisbon agenda.

The review of 2006 also introduced the new concept of co-modality, defined as "*The efficient use of different modes on their own and in combination*" in the aim to obtain "*an optimal and sustainable utilisation of resources*" (EC, 2006). While the previously used term 'intermodality' mainly represented a focus on modal shift from road to more sustainable transport modes, co-modality refers to the total efficiency of the transport sector. Thereby, it promotes not only modal shift, but an overall improvement of transport modes on their own and in combination with other modes. The new concept of co-modality will be promoted through public policies, such as standardization measures for interoperability between different transport modes. The European Commission also recognizes obstacles in their review of 2006, with regards to the integration of the increasing number of actors involved in the transport chains. An increased information exchange between the actors is concluded as one important step to overcome this issue (EC, 2006).

However, in March 2011, a new White paper was presented; addressing future guidelines and challenges of European transport development. The White paper states that: Road transport in excess of 300 km should be shifted to rail or waterborne transport (30 % by 2030 and more than 50 % by 2050)(EC, 2011). This is stated as an objective, regardless of considering the actual factors steering the actual choice of transport mode. This could be interpreted to be a step backwards to a modal-shift approach instead of a general co-modality approach. Critics interpreted it to be a step backwards, especially represents from the road transport industry. ERF Director General, Christophe Nicodéme, states: "We were told that modal shift was no longer the European Commission's policy and that road

transport would be treated on an equal footing. This has clearly not happened” (ERF, 2011). Also the secretary general of ACEA points out that the Commission signals a policy u–turn (EurAktiv, 2011). The road transport segment clearly signals its disappointment with the 2011 White paper.

3.2 Sustainable development- Triple bottom line

The concept of co-modality is in this report assessed with the theory of sustainable development as a foundation. The triple bottom line model will be used as a tool of evaluation for different logistic solutions. Therefore, it is vital to know what it represents and what the three main pillars of the triple bottom line incur.

“For firms to implement a sustainability strategy in their supply chain operations, the logistics function needs to play a key role because of the magnitude of costs involved and the opportunity to identify and eliminate inefficiencies and reduce their carbon footprint” (Dey, et al., 2011)

The expression sustainable development came into recognition in 1987 with the United Nations World Commission on Environment and Development report, ‘Our common future’. Often referred to as the Brundtland report, it stated the definition: *“Sustainable development is development that meets the need of present without compromising the ability of future generations to meet their own needs”* (United Nations, 1987). The Brundtland report was followed in 2005 by the United Nations 2005 World Summit Outcome Document, where the three pillars of economic, social and environmental were stated as interdependent and mutually reinforcing. The European Union adapted the three pillars of sustainability at the Copenhagen Summit. EU formulated the principle that *“sustainability not only comprises the natural heritage we pass on to the next generation, but also the economic achievements and social institutions of our society”*. The Commission also concluded that sustainable development is dependent on all three pillars, meaning that if one pillar is overlooked, the aim for sustainable development will collapse (Bader, 2008).

The corresponding triple bottom line model also refers to sustainable development. First coined by John Elkington in 1994 (Economist, 2009), the triple bottom line represents the three pillars through labeling them people, profit and planet. The triple bottom line has served as the foundation for many sustainability standards launched worldwide and it also represents the three main cornerstones in sustainable development which this report rely on. As Slaper (2011) states in his paper, the trickiest part in the triple bottom line approach is to have an equal measure of the three categories, as there are no common unit of measure. This problem is presented by Joumard & Nicolas (2009) that states that economic development is more focused and has higher priority than social and environmental development. This often means that when a decision is already taken, issues of the other dimensions are corrected and revised. Also Lammgård & Hagberg (2013) have shown from a transport perspective how the focus differs between research conducted within the three pillars of sustainable development. Economic and environmental issues were vastly more

covered than social aspects. There were also huge differences in the focus of social development between public policy measures and business issues, where the social part was almost non-existing within the business segments.

Furthermore, as there are no universal standard for the triple bottom line model or for the measures of it, it is highly adaptable to an individual study (Slaper, 2011). The different measures under subcategories economy, society and environment in this paper will be factors applicable to co-modality efforts in logistics, in other words the physical flow of goods. This is illustrated by one adaption of the model from a logistical approach by Green Logistics (2010) and could be seen in figure 4. The logistical activities that are included in this model are freight transport, storage, inventory management, materials handling and all information processing related to this.

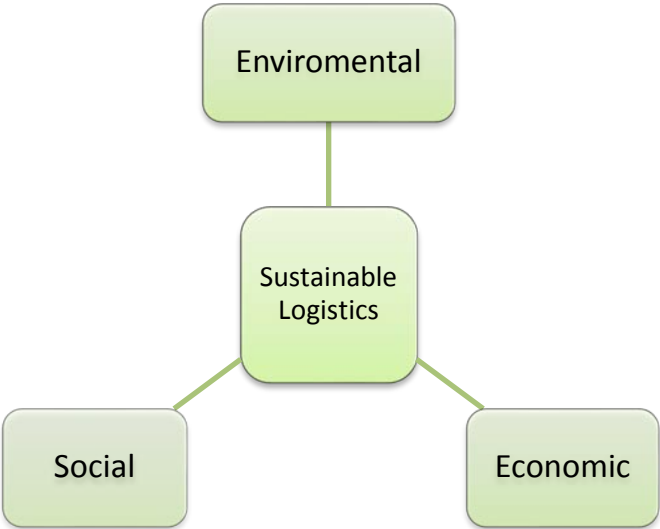


Figure 4: Triple bottom line – logistical approach

3.2.3 Social sustainability

The social aspect represents one of the three pillars of sustainable development. Despite being a vital part of sustainable development, it has been assessed and defined to a lesser extent compared to the intersecting domains of economic and environmental sustainability. One explanation to the neglect could be the varying perspective on what social sustainability represent, but also how it should be implemented and assessed (UNCC, 2014). This fact is also highlighted by McKenzie (2004) that argues that business tend to overlook the social part in the triple bottom line. The social performance is reported both infrequently and inconsistently across organizations. McKenzie (2004) stresses that one reason for the neglecting, is that most indicators of sustainability have been developed by consultancy firms that work on commission of large companies and their reporting. It is far more difficult to quantify social sustainability compared to economic growth or environmental impact. In contrast to environmental performance, which is a well-documented advantage in business, the social performance is more recent and has not yet proved to imply competitive

advantages. As a result of this, the social part has been the most neglected element of the triple bottom line. According to UNCC (2014), professionals, policymakers and scholars are all affected by the aspect, but a common perspective is lacking. In a very broad definition, social sustainability examines social institutions, interactions and relationships that have an effect on, or are affected by, sustainable development.

McKenzie (2004) defines social sustainability as: *“Social sustainability occurs when the formal and informal processes, systems, structures and relationships actively support the capacity of current and future generations to create healthy and liveable communities. Socially sustainable communities are equitable, diverse, connected and democratic and provide a good quality of life.”*

The social sustainability concerning transports presented by Green Logistics (2010) could be seen to have the same basic characteristics as the definition above. Combined with to work of Joumard & Nicolas (2009), Lammgård & Hagberg (2013) following main factors in social sustainability can be summarized as seen in figure 5.

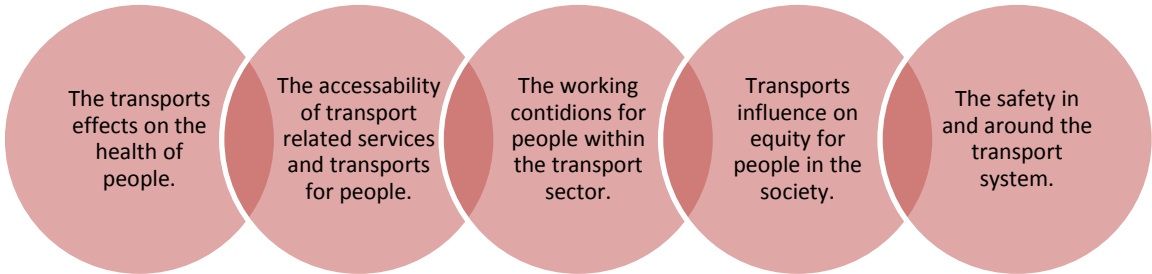


Figure 5: Social sustainability

Also EC (2006) presents a similar social focus, where the working conditions for employees in the transport sector, the accessibility of transports and safety is important features in the development of sustainable transports, however it not really explained what this actually means or how it should be archived. This is in line with is said above and is also reinforced by Barron and Gauntlett (2002), who states that social aspects are far less explored with lacking depth and clarity, compared to economic and environmental aspects. Social sustainability runs in many aspects parallel to economic and environmental sustainability, i.e. in terms of employment and pollution. This is the reason to the overlaps in the triple bottom line model, as issues will have an effect in all three areas.

3.2.2 Environmental sustainability

The pillar of environmental sustainability focuses on the viability and health of living systems on earth. Economies of modern times have started to acknowledge the need to manage scarcity in natural resources in a more sensible manner. To reach environmental sustainability, human activities should only use nature's resources at a rate where these can be replenished naturally. Therefore, variables measured in this category should represent management of natural resources and highlight potential influences on the viability of it.

Common measures are energy consumption, land use, air toxicity and waste (Slaper, 2011). From sustainable logistics that is presented by Green Logistics (2010), the work of Joumard & Nicolas (2009) and Lammgård & Hagberg (2013) the following main ideas can be summarized as seen in figure 6.

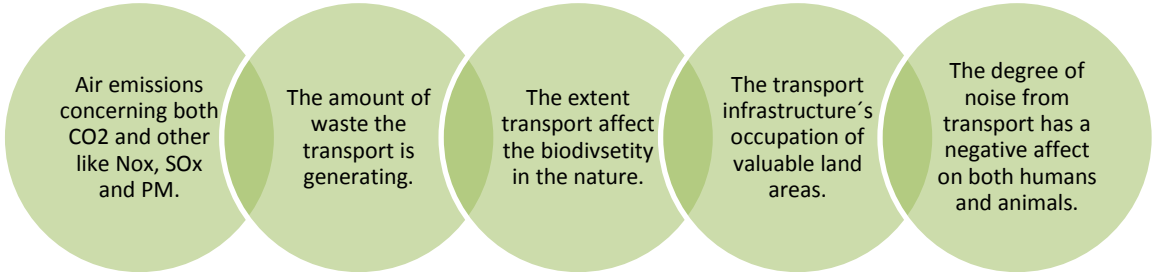


Figure 6: Environmental sustainability

3.2.1 Economic sustainability

The concept of economic sustainability differs somewhat to the traditional view on economic growth, which comprises a theoretically unlimited growth of gross domestic product. There are various opinions from economists that the traditional view on economic growth may be over, suggesting that sustainable efforts need to overrule the unrestrained growth. Green Logistics (2010), the work of Joumard & Nicolas (2009) and Lammgård & Hagberg (2013) presents combined the following main ideas about important factors that can be summarized as seen in figure 7.

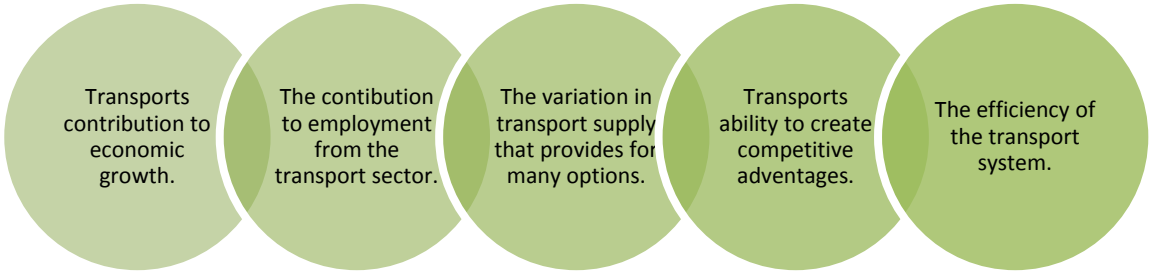


Figure 7: Economic sustainability

3.3 Co-modality

Co-modality is as explained in the introduction chapter concerning all different transport modes, both in combination and alone. To properly be able to apply the concept of co-modality, a description of the different transport modes is necessary. The transport modes will be explained individually from the three different perspectives that is the base of triple bottom line model. This is to give a good understanding about their individual strengths, weaknesses and development.

3.3.1 Overview transport development and modal split

As seen in figure 8 the development in EU-27, when ton-km are concerned, it largely differs between the transport modes in the last decade and also the split between the modes are unevenly disturbed.

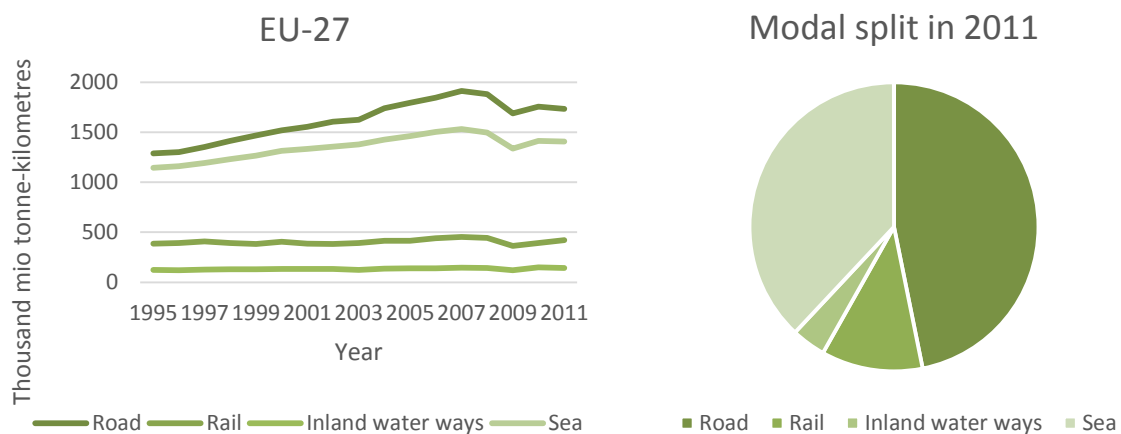


Figure 8: Freight transport overview EU-27

3.3.1 Road

Trend

The trend for road freight transportation within the EU-27 is that it is growing, as seen in figure 9. According to Enarsson (2006) the growth has been constant, especially after the Second World War. Between 1995 and 2011 there has been an increase of 34,6 % with an average of 1,9 % a year (EC, 2013a & Eurostat, 2013). From a modal split view the road transport has gone from 42,1 % to 45,3 % of the total transport work (ton-km) during the same period. Also in the modal split for only inland modes (road, rail, inland waterways and pipelines), road accounted for 71,8% of total ton-km in 2011 (EC, 2013a & Eurostat, 2013).

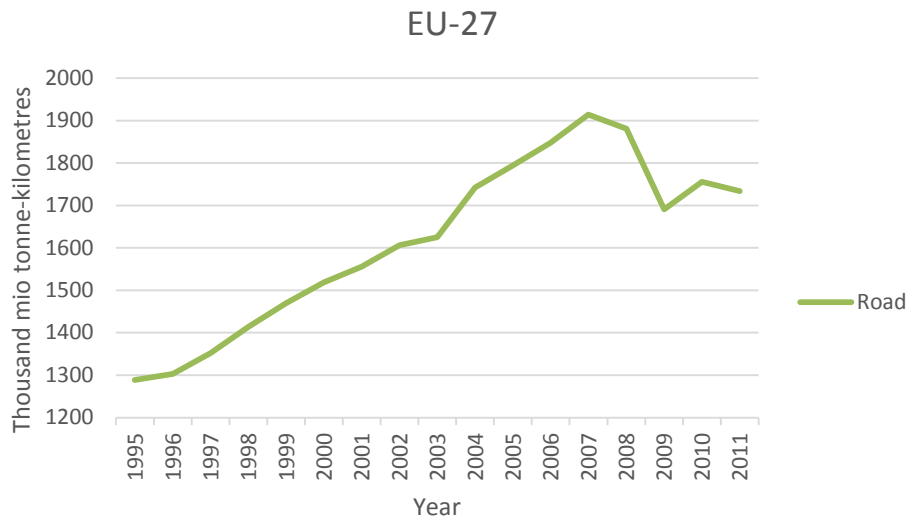


Figure 9: Road transport trend EU-27

Social

According to Enarsson (2006) the transportation costs for manufacturing companies are often very low. This is a result of the hard competition between road haulers with a very low profitability. Since the largest cost for haulers is the wages of drivers, there has been a situation where the different conditions between countries has formed a variable competitive market in international transportation. Between different countries in Europe, it is possible to see huge differences in the total costs for the haulers. Enarsson (2006) states that the competition with differing prerequisites, is a problem from a social perspective and causes large losses for some states.

The issue with road transports is heavily debated in Sweden and the Traffic Committee has recently proposed several focus areas for the government to look into. This is to ensure good working conditions and healthy competition in the road transport sector (Riksdagen, 2014). The suggestions concerns better control of freight transports, more powerful penalties when misbehavior, changes in cabotage rules, better work conditions and safe rest areas. Moreover, the responsibilities of the freight transport buyers has to be larger than today, according to the Committee (Riksdagen, 2014). According to Europaparlamentet (2014), the EU-parliament has promoted an opening of the road freight transport within the union. However, the parliament has always pointed out that the development in traffic safety and social issues must be harmonized with the opening of the markets. Sveriges Åkeriföretag (2014) says that there is a growing problem with violations against cabotage rules and the working conditions in the transport sector connected to both Swedish and foreign companies in Sweden. This results in market disruptions that are hard for serious actors to compete against. This problem is also stressed in the industry magazine Transport och Logistik (2013).

The road infrastructure has a vital influence how effective the road transport is and will be able to operate in the future. The characteristics of the roads when it comes to buoyancy, width and safety are not enough in many cases to allow as large and heavy vehicles that would be most effective and from a transport economy perspective better. The traffic administrations have stipulated several different regulations according to the road infrastructure that exists. The regulation concerns speed, length and weight of different vehicle combinations and varies between countries. These infrastructural based regulations could be seen to have a limiting and negative impact on the potential vehicle capacity, found in road transport (Lumsden, 2012).

One problem that has arisen through the growth of road transport is that the infrastructure has not been able to keep up with the larger traffic flows in numerous city areas, which has resulted in congestion in the road systems Gourdin (2001). This has a negative impact on the environment and the precision of the transports (Taniguchi & Thompson, 2003). The congestion also has a large effect on the society and the social life of inhabitants in these urban areas (Taniguchi & Thompson, 2003) and could be seen as contributors to nonsustainability according to Black (2010). It will be essential to have effective logistics that can provide efficiency to the cities in the future (Taniguchi & Thompson, 2003). Besides the congestion also other effects is allocated to road transport such as wear and tear on the public infrastructure, road accidents and noise (Heljedal & Persson, 2013).

According to Lumsden (2012) the existing infrastructure can be improved through different technological solutions. One problem in the traffic system that induces congestion is that different vehicles drive with different speed. One basic solution to this could be to harmonize the speed between all vehicles. It will require some kind of traffic control, but it still has potential to improve existing infrastructure. Another solution could be to connect vehicles with each other. This could be done either by a physical connection or by an electronic connection. The improvement of the traffic flow will be archived by reducing necessary braking distance between vehicles. However rules and regulations within road traffic will at the moment reduce the possibilities for this kind of solution. Also according to Taniguchi & Thompson (2003), the use of different Computerized Vehicle Routing and Scheduling (CVRS) systems has shown to have large benefits for the freight transports. The precision of the transports gets better, which results in reduced costs and shorter travel distances. This also has effects on the amount of vehicles that is needed on the system, and has therefore a good potential to relieve congested city areas.

Environment

There are growing environmental demands that puts pressure on to limit the emissions from road transport. The trend is that this demand to a larger extent is formed by the transport buyers (Lumsden, 2012). New standards of vehicles have successfully reduced emissions from noxious gases. However, in the current situation, the attention has changed and the focus is pointed at the growing emissions of greenhouse gases (GHG), such as CO₂ emissions

from road freight transport (Piecyk & McKinnon, 2010) The CO₂ problem could be tackled by different improvements within the road transport sector. For example, by using effective engines, alternative fuels and by creating and developing effective distribution systems Björklund (2012). According to Liimatainen et al. (2012), a large part of haulers are aware about methods and actions to be more effective and reduce the energy consumption. The reason for not implementing them could be seen as a result of the lack of resources and knowledge how to do it in an effective way. This is most relevant for smaller road hauler companies. Liimatainen et al. (2012) also stresses that energy efficiency seems to be less important to the shippers and the lack of recognized demand from the shippers' results in low incentives for the haulers to improve their road freight transport.

The view of the impact of the climate change is also recognized by Piecyk & McKinnon (2010) that describe climate change and CO₂ emissions as factors that play a significant role in the road freight sector and the logistical decisions that is taken within it. More than 50 % of road freight carriers predict that their business will be affected by climate change concerns to a large extent in 2015 and by 2020 the share is predicted to be 80 %.

According to Streimikiene, Baležentis & Baležentienė (2013) the quality and capacity of road infrastructure will have a great impact on transport activity and energy consumption in transportation, which in the end will affect society and the environment. Studies have shown that new infrastructure (roads) in the short term reduces congestion and by that also the environmental impact of the transport. However it has also been shown that new roads in a longer run has a negative impact on the environment since it induces more traffic.

Economic

The total share of road transport is growing globally and the major contributing factor to this trend is the higher transport demands from the industry, where road transport has the ability to in an effective way meet requirements of speed and flexibility (Windeck, 2012). The key factors to the success and the growth is based on the basic characteristics of road transport and the business connected to it. These could be divided into six factors, and they are: small scale, flexibility, security, reliability, service and adaptability (Lumsden, 2012). Also Heljedal & Persson (2013) recognize the success of road transport from the fact that it is fast, reliable, flexible and comparatively cheap.

The ability of road transport to act in a small scale is based on the nature of the small vehicle, compared to other transport modes. This condition is useful for the customization to be able to meet the specific transport needs of every single customer. This also provides the transport buyer with effective and attractive relations with the transport provider (Lumsden, 2012). As said by Enarsson (2006) the market for smaller consignments, of parcel size, has grown rapidly the recent years, which has led to growth of both small local road transport companies and larger ones. This growing trend will most likely continue with the e-commerce in the B2C segment. According to Lumsden (2012) the flexibility of road transport is achieved since it is highly adaptable to changes of the route during transport.

Furthermore, the possibilities to use different combinations of vehicles with various capacities provide flexibility and can also be used for temporarily extension of the capacity to match the customer demand. The relative small amount of goods that is transported by each vehicle is providing high security for the goods, since the driver has less goods to keep track of compared to other transport modes. The security provides for low damaging and theft of goods, and also allows the general comfort of the goods to be high.

Road transport is reliable from the aspect that the goods are followed by a driver the entire way. The goods are in custody of the driver throughout the carriage and this provides a reliable transport solution (Lumsden, 2012). The presence of the driver also gives options for providing good service. The driver often has the ability to solve the transport buyer’s problem at the location, since he has both knowledge and good connection to the transport company. This service offer is seen to be used more frequently and has a great potential to be expanded even more in the future. The nature of the road transport business is that every vehicle often is an independent economic unit. This gives a situation with high adaptability where adaption is made to get access to local freight on a low level (Lumsden, 2012).

3.3.2 Rail

Trend

The recent trend for rail freight transport within EU-27 shows a slow development in terms of total ton-km transported, as seen in figure 10. Between 1995 and 2011 there has been a decrease of about 8,8 % in the rail freight within EU-27 and in the modal split the rail has gone from 12,6 % to 11 % of the total transport work.

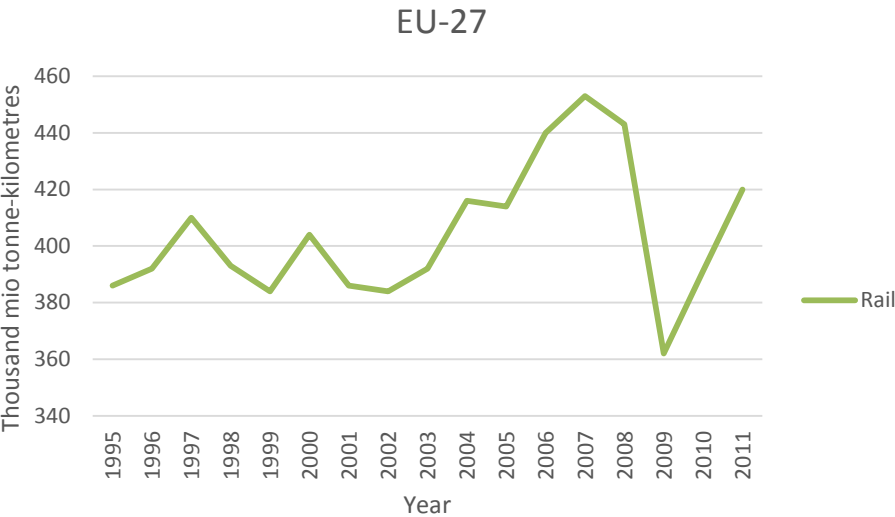


Figure 10: Rail transport trend EU-27

Social

Significant with the rail infrastructure is the sparse nature of it, especially if it is compared to road infrastructure within the same regions. It is important to understand that a major part of the rail infrastructure were both planned and built several decades ago and therefore developed to the demands of another time age. Large parts of original rail infrastructure networks have been shut down because of low transport demand and with that, low profitability. This is often a direct effect of the basics of rail freight since it is most suitable for large goods flows. In other circumstances, other transport modes have been more attractive and have provided better efficiency. The infrastructure has then been adjusted for the business environment perspective and left is often only a core network that has the necessary volumes of goods (Lumsden, 2012).

According to Lindegård (2012), there are some basic problems in the railway infrastructure industry when it comes to renewal and development. The focus is to use familiar business models to be able to calculate long term costs. However this can be seen to have a downside since possible innovations is rejected due to the detailed specifications, standards and market and technological lock-in effects. The monopoly situation that the infrastructure buyer often experiences, has also been a contributing factor to technology and market lock-in effects, since the buyer often holds on to the material and products that is used in the industry (Lindegård, 2012).

As stated in the previous section concerning rail shuttles connected to dry ports, this represents one area where the development of rail frights is moving forward. The shuttles do not only give economic benefits for the actors involved in the transports. They also contribute to reduce the environmental strain and noise connected to the traffic related to ports located in close proximity to urban areas (Bergqvist & Woxenius, 2011). The road congestion and the need for investments in road infrastructure are also influenced in a positive way, as well as the land use in port areas (Roso, Woxenius & Lumsden, 2009).

From an EU perspective, the liberation of rail freight transport is an important step to make the rail freight sector able to contribute to the growth of freight markets within the union. The national railway markets have traditionally been monopolies and closed, which has resulted in difficulties and low willingness to respond to new challenges in the freight market (Eisenkopf, 2006). According to Kirchner (2006), the process of de-regulating the rail market in EU has been implemented through several different railway packages, which from a legal perspective decreases barriers and harmonizes the market. As said by Enarsson (2006) there are many barriers between railways in Europe that makes it difficult for international railway to be competitive. These barriers concern electrical power supplies, signaling systems, track conditions, operational rules, education of drivers and linguistic difficulties. As a result of the increased willingness to improve the rail freight sector, the European Commission has formed a plan for a core network called TEN-T, where rail is included and consists of nine core network corridors (European Commission, 2013b). This core network is then supported

by comprehensive routes which are feeding the core network. This will be done on both a national and international level. Regarding the rail infrastructure, this will play an important role, with rail connections to ports, airports and upgrades to high speed railways.

One of the most important matters with infrastructural developments within railway infrastructure in EU, is the implementation of a new Intelligent transport system (ITS) (EC, 2013b). According to Franklin, Nemtanu & Teixeira (2013), ITS have three main areas for beneficial improvement within transport. These areas will improve safety, increase efficiency and reduce negative impact on society and environment. The new ITS within the railway sector in EU is called European Rail Traffic Management (ERTMS) and must be used through the major transport corridors in the future to meet the EU standards (European Commission, 2013b).

Environment

Rail transport has according to McKinnon, Allen & Woodburn (2010), fundamental environmental advantages compared to road transport in the movement of goods, this is true for both for electricity and diesel fueled trains. When comparing diesel powered rail transport to road transport, the diesel train generally produces less emission, except for sulphur dioxide (SO_x). However, there have been little improvements in the rail sector compared to the road sector when it comes to further reduce the environmental impact of the transport. There will probably be a trend to focus more on the effectiveness of rail transports in the future. This is due to higher energy prices, but also to be able to reinforce the environmental advantage with rail transport over road transport of goods. This is possible due to the nature of rail with its low rolling resistance.

According to Matsika et al (2013) there are four key factors that have affected and influenced the design of a rail freight vehicle and in the end, the efficiency of rail transport. These driving factors are technological improvements, customers' demands, different governmental policies and operational requirements, see figure 11. As said by Lindegård (2012), innovations and development in the infrastructure and the in the railway industry is often slow, which limits the operational requirements that the railway industry has to cope with. The market demand (Matsika et al, 2013) has an influence by the type of goods that needs to be transported and the value of it, but also costs connected to the operations and purchase of the vehicle.

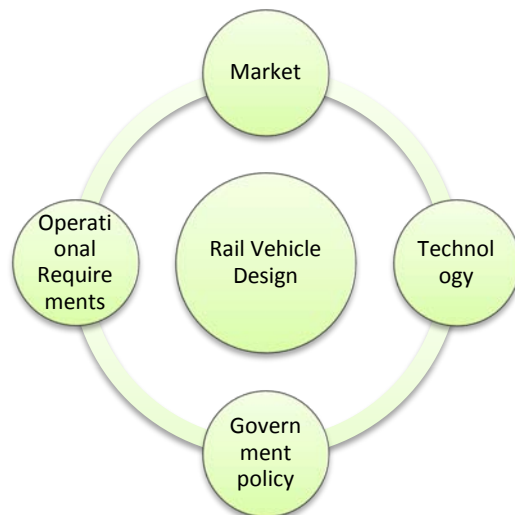


Figure 11: Rail vehicle design

There are several different potential environmental standards that could be raised to reduce the environmental impact of rail freight (McKinnon, Allen & Woodburn, 2010). This could be achieved by maximizing the electric traction and by producing electricity from non-fossil fuel sources. Furthermore, also development and investment in low-emission diesel locomotives in areas where electric railway is not possible. Another factor is to reduce the sulphur in the fuel that is used. In 2012 EU legislation was implemented to reduce the SOx emissions from rail. Other issues like noise and vibration could be addressed through technical improvements in for example train engines and breaks (McKinnon, Allen & Woodburn, 2010).

Economic

The basics of railway transportation are the low friction between steel wheels and the steel rail. This provides for a low rolling resistance and thereby, less energy is used to move a railway wagon forward in relation to a comparable road transport. The low rolling resistance is a critical condition for the possibility to connect several rail wagons to each other to form a larger unit. This unit can be then be moved with low energy consumption and with few people (Lumsden, 2012).

According to Gourdin (2001) the nature of rail transportation makes it useful for larger goods flows, since these large volumes and weights is needed to utilize the total capacity of a rail transport unit. As said by Enarsson (2006) these prerequisites indicate that rail freight transport should be cheaper compared to road transport for low value goods over long distance. Also Gourdin (2001) points out the railway's advantage over long distances and large quantities of goods. As said by Matsika et al (2013) carriers of rail transport is therefore characterized by very long sets and often travels in a relatively slow average speed.

Due to the nature of rail freight, Gourdin (2001) stresses the importance of having systems connected to other transport modes. This allows for concentrated flows of goods at railway

terminals, since the basic need for rail transport is economies of scale, which require large flows to get high utilization. Enarsson (2006) states that to fully utilize rail transport, a balanced flow of goods is required. However, as it is today it is not unusual to find railway transports with a high degree of empty wagons. This is often because of the design of the production systems in the industries, where raw material is transported by rail to the industry and the finished high value goods is then transported by road freight.

Freight transport on rail can be separated into five different segments, which are: express freight, wagon load, unit load, block load and unit trans (Lumsden, 2012). According to Matsika et al. (2013) there are several different wagon types for rail freight transportation which are designed for different types of goods. Hoppers and tankers are specialized for bulk transport, such as oil or coal. While flat wagons are used for containers, logs, pipes and piggyback transportation. Box wagon could be used for palletized goods or coal and there are also refrigerated and special wagons that are used.

Express freight is carried in the normal rail traffic (passenger transport) and is characterized by small volumes and weights. Wagon load is when the transport buyer uses an entire wagon. There are often some criteria concerning to reach some utilization of the wagon for using this option. Unit load is a shipment in a large load unit and could for example be a container or a swap body. This is frequently used in intermodal transport solutions Gourdin (2001). Every type of unit has its own special characteristic and the handling is used by different equipment for the most effective treatment of it. According to Windeck (2012) is the cargo handling cost high in the rail transports compared to road. The block load principle is to cut an entire train into several different blocks. The principle is similar to the unit trans when it comes to one loading place and one destination. However, in this case the capacity is divided between several different shippers. The unit trans is when the entire train is used by the same shipper which means that there are one shipper and one receiver of the goods. This alternative requires large flows and is often as a part in the production process of companies. The advantage is shorter lead times, since no extra handling is performed on the way (Lumsden, 2012).

Lumsden (2012) also states that the trend is moving towards larger consignments, where especially the block load and unit trans has been important drivers. This could be seen as a result of the advantages with rail concerning large volumes, but could also be seen as a failure to compete against road transport concerning smaller consignments. Also Enarsson (2006) recognizes the advantages of rail transport in the unit load segment without loading/unloading under the entire distance, where potential lies between large companies, warehouses and ports. There are patterns that indicates that rail freight is decreasing when the value of products are increasing and in regions where the industrialization is high. This is due to the problem of adaptability from the rail transport to the demands of new industries when it comes to flexibility and change (Lumsden, 2012).

However, in contrast to this development, there has been an increase of short distance rail shuttles to and from port areas in European countries such as UK, Italy, Spain and Sweden. There has been a modal shift from road to rail, where rail has recaptured market shares from the road sector (Bergqvist & Woxenius, 2011). The shuttles are connected to inland terminals that are often defined as dry ports. There are three different categories of dry ports that can be categorized and described from the functions and locations. The different dry ports are distant, midrange and close (Roso, Woxenius & Lumsden, 2009). From an economic perspective, usage of dry ports could provide less costs, less time in the port and less risk for delays in port for the goods. Downsides could be seen in higher pressure on the rail system, with congestion as a result (Bergqvist & Woxenius, 2011). The dry ports also provides for the port to be able to secure the hinterland and give better services to shippers and transport providers (Roso, Woxenius & Lumsden, 2009).

3.3.3 Sea

Trend

The trend for freight transportation on water is that the sea segment has a growth of 22,8 % in ton-km between 1995 and 2011 in EU-27, se figure 12. From the view of the modal split the sea had almost the same share 2011 as 1995, with about 36,8 % of the total transport work in ton-km in EU-27 (EC, 2013a and Eurostat, 2013). Under the same period the inland waterways segment had an increase of 15,6 % in ton-km, see figure 11, and the share in the modal split had gone from 4,0 % to 3,7 % in ton-km.

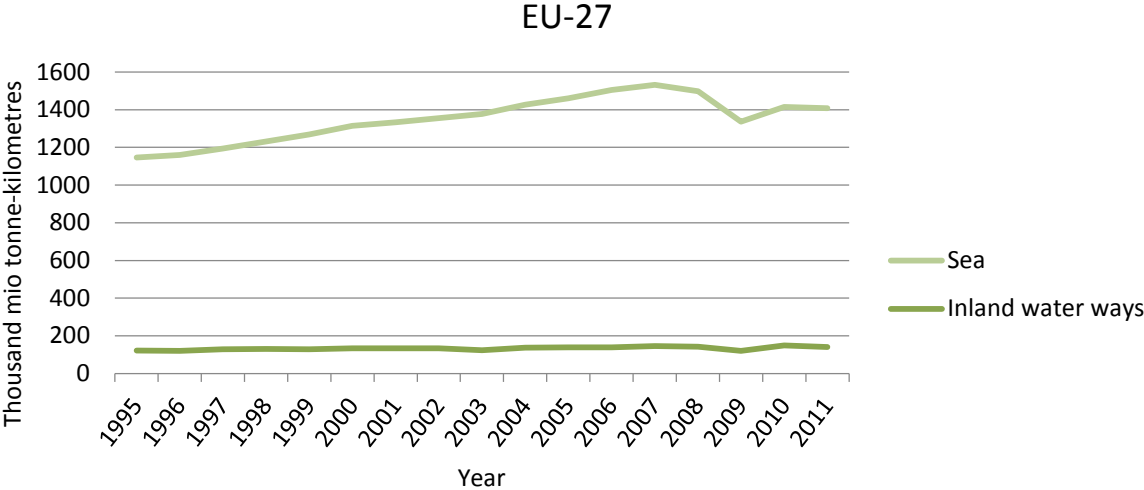


Figure 12: Sea transport trend EU-27

Social

As stated in environment section, seaborne transports are contributors to hazardous substances. People living in coastal cities are to an extent affected by the emissions containing nitrous oxides (NOx), sulphur oxides (SOx) and particulate matter (PM) (Stopford, 2009). While the actual seaborne transport does not impose any major congestion, the ports

acting as important hubs are the cause of issues such as congestion and use of valuable land areas.

The social dimension of seaborne transports also concerns the people on board the vessels. The International Maritime Organization provides treaties concerning on-board personnel safety and working legislation. One of the vital treaties is the Safety of Life at Sea convention (SOLAS). This treaty ensures that a vessel flagged within a signatory state of IMO complies with safety standards in terms of operation, construction and equipment (IMO, 2014a). This treaty is regarded as one of the most important and utmost concerns the safety of people at sea.

Another treaty concerning labor standards for seafarers is the Maritime Labor Convention of IMO (MLC). This treaty enforces minimum requirements for labor, conditions of employment, accommodation and health protection for people working on board. The convention applies to vessels flying a flag state which has ratified the convention but is also applicable for vessels entering a port state which has provided ratification. With the ratification from the Philippines, which represents nearly half of the world's seafarers, this treaty provided for improved labor standards for seafarers (ILO, 2012).

Environment

Traditionally, shipping has been regarded as the most environmentally sound mode of transport (Bode et al, 2002: Browne et al, 2010) Fact is, that compared to other transport modes, shipping generally emits lesser amount of greenhouse gases (GHG) emissions per unit. Instead, the main issue for the shipping industry is being emitter of other pollutants, such as Sulphur oxides (SOx), Nitrous oxides (NOx) and particulate matter (PM) (Cullinane, 2012). This is the type of fuel used by ships, which generally has high sulphur content. On average, shipping bunker fuel contains 27 000 ppm (parts per million), compared to the 10-15 ppm used by road vehicles in Europe (Browne et al. 2010). The relative advantage of shipping comes through its low energy consumption per load unit compared to other transport modes. However, as shipping has a large share of the overall transport work, the emissions stemming from it still remains an environmental concern for GHG as well as other emissions.

Increased awareness of these issues in combination and new regulations has forced actors within the shipping industry to adjust and increase efforts to reduce the environmental impact from shipping. The international body of shipping, International Maritime Organization, amended its MARPOL convention titled 'Regulations for the prevention of air pollution from ships' with new guidelines on preventing air emissions from ships. The current Annex VI of was implemented in 2010, containing a series of revisions. The purpose of this annex is to limit airborne emissions stemming from ships, primarily focusing on sulphur emissions, NOx, volatile organic compounds (VOC) and ozone depleting substances (ODS) (IMO, 2013). Annex VI of MARPOL also provides guidelines for particular geographical areas, where particular environmental efforts are necessary in terms of preventing air

emissions. These areas are defined as Emission Control Areas (ECA), where SO_x and NO_x are particularly concerned. An ECA can either be designated to limit sulphur emissions and particles (SECA) or to limit NO_x emissions (NECA). Some areas are classified as vulnerable to both types of emissions and therefore provides strict emissions caps for both SO_x and NO_x emissions (IMO, 2014). Currently implemented ECAs are displayed in figure 13.

IMO Worldmap for ECA's (Emission Control Areas)



Figure 13: IMO - World map for Emission Control Areas

As a consequence of these new provisions, shipping carried out in these areas are forced to comply to the new emission caps

Subsequently, ships operating in either of these areas are forced to limit emissions to the set level according to the Annex VI, regulation 14. As the first area where ECA regulations has tread into effect, the Baltic Sea is since 2005 a Sulfur Emission Control Area (SECA) where SO_x limits in emissions are subject to be lowered stepwise over the years to come (as per Regulation 14.1 and 14.4, Annex VI, MARPOL) (IMO, 2013).

Economic

Shipping has played an important role throughout the history of mankind and it continues to be a great contributor and driver in the global economy of today. Waterborne transports can be divided into a various number of subcategories, each with its own characteristics. As the liner and tramp segment was separated in 1950 (Stopford, 2009), one major dividing was made up within the shipping industry. Liner shipping is characterized as a transport service for consignments which are too small to fill up a single ship. Therefore, shipments are grouped with other cargoes for transportation. The vessel in a liner service operates according to predetermined scheduled ports, with fixed prices according to certain tariffs (Stopford, 2009).

Tramp, or bulk shipping, is the clear opposite to liner shipping. The bulk shipping industry provides transport services for cargoes of shipload size. The bulk segment is split into four

general categories: tanker, dry bulk, combined carriage and specialized bulk (Stopford, 2009). Where the tramp/bulk market mostly resembles to a taxi service with different cargoes and different port of calls, the liner segment is recognized as bus service with predetermined routes and a set time schedule of sailings.

The shipping industry can also be divided into narrower subcategories. The liner shipping industry is dominated by container shipping, where large container vessels carry shipments around the world according to fixed schedules. Standardization due to load units and economies of scale through larger vessels, has led to a significant growth of container shipping, which now represents a large share of the transported commodities of today. Another segment within liner shipping is the RoRo (Roll on Roll off) segment. With purpose built ships, this shipping segment has specialized in carrying trailers and equivalent cargo and has thereby given it the name Roll on Roll off Windeck (2012). RoRo shipping is frequently carried out on short sea routes in contrast to container shipping, therefore suitable for i.e. intra-European shipping.

The bulk segment, with its dividing into tanker, dry bulk, combined and specialized shipping also aims at economies of scale, as it is possible to carry large quantities of i.e. crude oil, iron ore and grain on a single transport leg.

Furthermore, inland waterways are also used as transport corridors in certain areas. This is a segment within shipping which differs in many areas compared to other shipping segments. Inland waterway shipping is often carried out by barges instead of regular ships, as the vessels never enter open sea. The European Union promotes inland waterway shipping through its action programme NAIADES, where they claim it to be a safe mode of transport with low costs, lots of spare capacity, no congestion and low environmental impact (EC, 2006).

3.3.4 Summary of the transport modes

Figure 14 below, is a simplified summary of the transport modes presented. It is based on the detailed descriptions of the different transport modes in the previous section.

	Road transports	Rail transports	Sea transport
Strengths	<ul style="list-style-type: none"> Flexibility Adoptability Speed Low handling costs 	<ul style="list-style-type: none"> Environment Economies of scale Capacity 	<ul style="list-style-type: none"> Environment Economies of scale Capacity
Weakness	<ul style="list-style-type: none"> Environment Congestion Traffic safety Work conditions 	<ul style="list-style-type: none"> Lack of infrastructure Different standards Low flexibility 	<ul style="list-style-type: none"> Speed Handling costs Land use Congestion in ports

Figure 14: Summary transport modes

3.4 Surface of competition

The surface of competition could be seen as situations when several different transport alternatives have the ability to reach the needs of a shipper (Engström, 2004). The surface of competition can be seen both from a perspective within a specific traffic mode (intramodal) and between different transport modes (intermodal). To understand and specify the surface of competition is not that easy, since no transport mode is homogenous and all transport modes has different strengths and weaknesses compared to each other (Trafikverket, 2012). These different mode specific attributes can be simplified and generalized, as discussed in the previous chapter regarding the different transport modes in this thesis.

It is possible as seen in figure 15, to show the surface of competition between the transport modes on a very general level, this is based on volume of the goods and distance of transport. The primary surface of competition is where the different transport modes are overlapping each other. However this model should just be seen as an indication of surface of competition, since various factors like reliability, cost, frequency and security also has significant impact on the competition (Trafikverket, 2012).

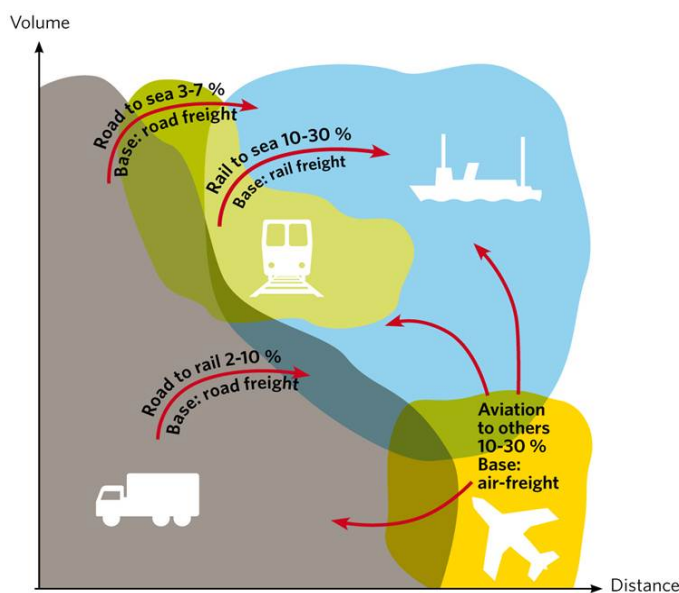


Figure 15: Surfaces of competition

These surfaces of competition are not constant, according to Trafikverket (2012) both internal and external factors affects the transports and then also the surface of competition. These changes could be a result of technical improvements, attitudes, regulations or economic incentives. Different changes of this sort could therefore either improve the competitiveness for a mode or decrease it, which will have an influence on the surface of competition.

3.5 Philosophies of improvement

Within production industries, there are several methods for constant improvements as seen by the authors. Since co-modality is hypothetically addressed as comparable to philosophies of improvement, this section will cover the most widely spread of all philosophies of improvements, Kaizen. This philosophy is selected since it has a clear structure with several tools to use.

The Kaizen philosophy was invented in the 1950s in Japan as a result of upcoming problems in the manufacturing industry (Singh & Singh, 2009). Today the term Kaizen is a well-recognized concept that represents a process that has continuous improvements. This improvement is possible to be archived by every employee done in the standard way of work (Chen, Dugger & Hammer, 2000). As said by Singh & Singh (2009) Kaizen is in the manufacturing industry accepted as a well-functioning philosophy; however there should be possibilities for Kaizen to be applied in other different areas. The Kaizen philosophy can be seen to form a model with several different techniques for efficiency improvements and measuring techniques (Imai, 1986), these are presented in figure 16.

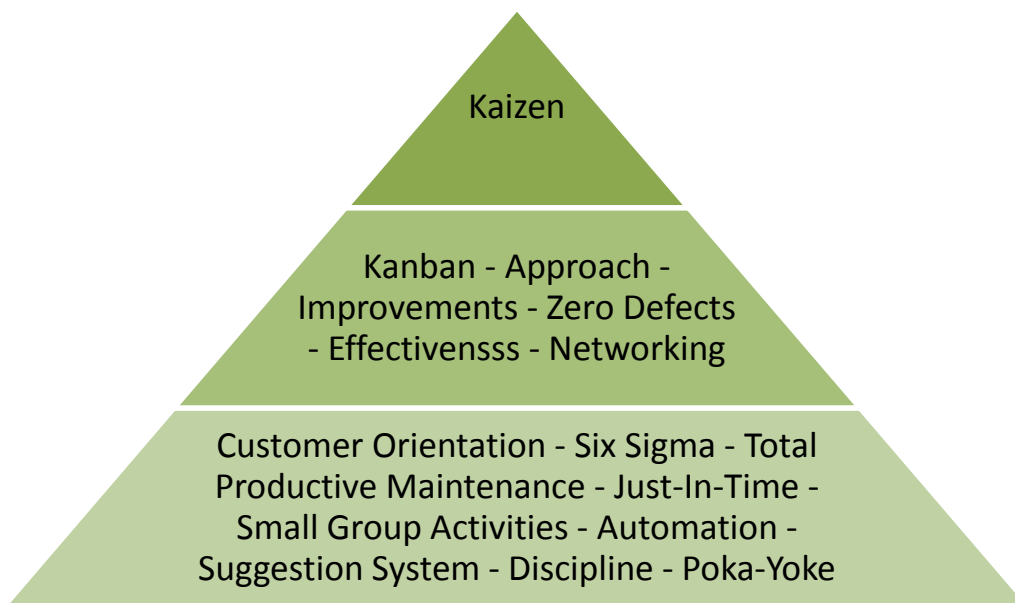


Figure 16: The Kaizen model

The Kaizen philosophy has also shown to be successful in the road transport sector, where it has pushed the development of transmissions, driver trainings and the use of alternative fuels. This best practice has resulted in better fuel economy and savings (Commercial motor, 2012). According to Shingijutsu Global Consulting (2012) there is often ineffectiveness that exists in the logistical processes such as loading / unloading of goods, the warehousing and trucking. These waste factors are often unrecognized, which gives hints about potential for implementation of Kaizen activities in such operations connected to transports.

According to García et al (2014), the benefits of implementing a constant improvement system like Kaizen are many. It can be seen to have positive effect on social, operational and technical aspects within an organization, but also improving the relations to stakeholders such as customers and business partners. García et al (2014) also stresses that the key to successful implementation of Kaizen, is management commitment and employee training.

4. Empirical Findings

This chapter will present the result from the semi-structured interviews that were conducted as the primary data collection in the research. As stated in the method respondents were chosen to represent three different segments that have different relations to freight transports and issues around these questions.

4.1 Introduction of the respondents

The first group of respondents represents the strategic level. The respondents were Stefan Back who is head of Sustainable Logistics in the Transport Group, which is an umbrella organization for association and transport companies in Sweden and Mats Boll, who is Director of Transport Policies at Volvo Group.

The second group represents the operational level. The respondents were Maria Jönsson, who is Head of industrial development at Bring Frigo and Anders Bergström, Purchasing Manager Commodity Sea and Rail at Volvo Group Logistics Services and finally Lasse Holm that is operations manager at Q3 an organization that promotes sustainable transports.

The third group represents the scientific level. The respondents were Åsa Arentun, researcher at VTI and Catrin Lamngård, who is a University Lecturer within the field of sustainable logistics at University of Gothenburg.

4.2 Co-modality

The respondents were asked about if they have heard co-modality before and knew what the co-modality concept is about. They were also asked about their opinions about the concept and its usefulness for improving freight transports.

Stefan Back was well familiar with the co-modal concept. According to him is co-modality a necessary approach to tackle the issues in the transport sector, since it captures much of what is needed. He stresses that the transportation is not a noll-zum game where it is possible to choose between traffic modes, and this is important to define. Therefore the improvements in all modes by their own and in combination are important for the entire society. From a Swedish perspective, the transport industry as a whole is positive towards the co-modal thinking according to Stefan, and is built on the same thinking that the freight transport delegation has had since the 1990s. He also said that different transport organizations within Europe are positive towards co-modality. However, there are often politicians that hamper the co-modality. Stefan Back is critical towards the European Commission, that in 2011 went back to a modal split thinking, since co-modality ended up in the backwater again. He states that one problem is that politicians like the idea to transfer goods from road from rail, the entire transport work will increase by 50 % in the EU until 2050 and the goal is to transfer 30 % to rail from road. This means that actually nothing will be transferred.

Mats Boll recognizes co-modality and is aware of that it was first introduced in the European Commission white book in 2006, which he believes was made from political reasons to find a gathering expression for the goals that they wanted to achieve. He states that co-modality is important for Volvo and they have a positive view of it, since their operations span worldwide. From a global perspective, the focus is in the same areas as in co-modality, but the degree of development is what the real differs according to Boll. He also states that co-modality as a concept only exists in Europe and that in other parts of the world is regarded as the same thing as intermodality, which in literature is an established expression globally. Mats Bolls opinion is that intermodality is concerned with respectively transport modes, while co-modality connects them. Mats Boll does not see the co-modality as a method or practices for improvements, but rather as a way to describe different transport relations. However, he also states that improvement thinking could be used in the improvement of the co-modal transport system. Anders Bergström, who has a more operative role in Volvo, had never heard about co-modality. The same goes for Lasse Holm, who stated that he never have heard about co-modality and therefore has no direct opinion about it.

Åsa Aretun says that she recognizes co-modality from two different aspects. These are from a policy perspective and from a scientific perspective. She further states that the two different areas are overlapping each other. The policy part has to be seen from an EU level, where co-modality is functioning as a transport policy where every traffic mode should be used in an optimal way for the specific transport mode concerned. She interprets it as the transport modes should complement each other. This differs against intermodality that is about building transport system where the transports should be used on an intermodal way. In her opinion there is a floating line between the concepts. She also perceives that the trucking industry and its industry partners was intermodality sensitive. It was easier to get a dialog between all different stakeholders in the transport industry by introducing co-modality. This was because co-modality could implicate intermodal solutions for the ones that wished that, but it was not necessary to connect different transport modes in a system. In the scientific approach co-modality is used almost as a synonym to intermodality according to Åsa. Some difference can be discerned, but there is not the same political explosiveness as in the policy discussions. She also says that co-modality was more current for about five years ago in science and that it has been a rapidly shift towards intermodality. She are not aware if there are any scientific research made on co-modality at the moment, since intermodality is more common way to look into transport related issues at the moment.

Maria Jönsson says that she does not have that good knowledge of co-modality, instead they are only talking about intermodal concepts for solutions. She understands co-modality as a wider perspective compared to intermodality and that it concerns the total transport system and not just the production structure of single organizations. Catrin Lammgård regards co-modality as the connection between for instance sea and hinterland transports or rail and road.

4.3 Improvements in freight transport

The respondent from the transport categories were asked about what they think is the key to develop and make the transports more efficient.

Stefan Back stated that a key role to be able to manage the growing transport demand in the future is to use all different transport modes parallel to each other. He also believes that a more integrated transport system is important in order to push the development forward, currently there are barriers and obstacles between the different transport modes. In connection to this, he is very critical to how the railways in for example Germany works against the opening between infrastructures. He also talks about the discussion against larger trucks in EU and find that the arguments are strange, since they often are based on irrelevant scenarios or competition against railways and not on the fact that larger trucks in many cases are more effective than smaller ones. He thinks that the railway sector needs to develop to be able to meet the customer demand, instead of obstructing the development on other transport modes. This is to a large extent a political issue, according to Stefan Back.

The large challenge with the transport sector is that there are so many different stakeholders with different prerequisites involved. To be able to improve transports, it is therefore important for the different actors to communicate and understand each other. By understanding the other parts of the supply chain, it is possible to work together and improve the entire system. He also states that research often is too focused on technical solutions, while he believes that it is important to look at business models. This is necessary in order to understand every actor's part of the whole picture and to develop the systems around these factors, instead of just looking at single part of the chain at a time. One small change in some part of the system can result in a new solution that is more effective, according to Back.

Mats Boll states that harmonization is the key to improve the transport sector, especially when it comes to railways. This has to do with both rules but also different technical standards. For example, their block train from Hannover to Gothenburg had to stop and change locomotive four times, due to different regulations etc. He says that Sweden is a good example of the integration and cooperation between different stakeholders such as authorities', companies and other associations. He believes that openness is a basis for a well-functioning transport system. In central and south Europe there are more conflicts between stakeholders and interests in the transport sector. The openness that characterizes the Scandinavian market is seen to be naïve in these parts of Europe.

The technical development in the transport sector is not the largest challenge according to Mats Boll, instead it is the integration and cooperation between different actors. It is important to see transports as a large system, where everyone is and has the right to be involved. By improving this part, the overall system will be more efficient and reliable. Boll also mentions the discussion about encasing the length of trucks, which he believes is a

result of that the railway sector feels threatened by this. He also states that there often exist two agendas, where the political interests are controlling the development.

Maria Jönsson states that the large challenge that they have every day is to find balances in the transport flows. When they are considering new business ventures, it is central to consider these issues. The key to solve these balance issues is communication. It is important to have a well-functioning dialog between the external stakeholders involved, but also on an internal lever between the different store facilities and transport leaders. The daily communication is extremely important to be able to handle this challenge. This is both from a human dimension and a system dimension, a transparency that provides useful information to everyone concerned. Bring has solved this through an internal market for capacity. Jönsson believes that there still lies potential in developing these kinds of solutions. Also the communication with customers is important and has potential to be developed further. She says that one typical situation could be that a customer has booked transport for a number of pallets and that there are no space for a few in the normal flow. Instead of taking one extra truck for these, it is better to call the customer to get an understanding about the need and if it is possible to send them later and thereby avoid a transport with low utilization. Maria Jönsson also sees the potential to work with other transport actors to be able to operate more efficient.

Lasse Holm states that to develop transport from a sustainability perspective, the transport buyers are key actors for improvements. They are the ones that supply the transport sector with money. As long as the buyers do not care or have a focus on these issues there will not be any improvements. He also states that there is potential with quite simple methods such as put function demands instead of very controlled demands. This opens up for discussions, new ideas and customized solutions. By building partnership based on the same values, transport buyers and suppliers create systems for sustainable transport improvements.

Anders Bergström states that the way to build and develop effective transport solutions is the collaboration between different stakeholders. He also says that the development of transport corridors is an important part to be able to streamline the transport flows. It is important to build strong relationships in the development of the transport solutions. A key is to from an early stage involve all parties on an operational and commercial level and to consider the balances that often are the largest problem to solve. By actively search for cooperation opportunities with other companies and branches, the empty transports can be reduced, hence the efficiency and costs will go down. According to Bergström, the most difficult part when developing a new transport corridor is to build a business case that is sufficient.

4.3.1 Co-modal cases

Train 8 - Volvo Group

One successful transport case that Volvo Group has developed is the *Train 8* according to Anders Bergström. The solution is based on a successful collaboration between Volvo Group

and other actors both in a domestic and in an international transport corridor.



Figure 17: Train 8 route

In the international transport corridor, AB Volvo has developed a successful collaboration with Volvo Cars. Even though two separate companies, they have managed to combine their volumes to build a block train solution together. AB Volvo is transporting goods by single wagon system from Umeå to Älmhult, where they are building block trains in collaboration with Volvo Cars. These are then transported to Gent in Belgium. By having collaboration they have the opportunity to get the benefits of a block train without taking too large financial risks, since the risk is shared with Volvo Cars. Anders Bergström also states that the utilization is very good in this case and that it is more built in to the system compared to if they would have been handling it entirely alone. This is due to that they have five trains every week to Älmhult and then ten block trains from Älmhult to Gent. It is therefore easy to scale up or down the capacity that responds to the actual need and thereby reach better capacity utilization in the end.

The domestic transport corridor collaboration is based on the imbalances that Volvo Group had from Umeå to Gothenburg, according to Bergström. By using their multipurpose wagons, they can transport regular cars in the same wagons as the goods from Umeå are transported in. AB Volvo has started collaboration with Autolink to reduce the imbalances they have in this northbound transport flow. By finding the solution where Autolink is transporting cars in the same wagons as Volvo Group, they have managed to increase the utilization from Gothenburg to Umeå by 20 %. For the Volvo Group, this results in lower transport costs and increased utilization of their terminal. For an environmental perspective this is also positive since the emissions of CO₂ are decreasing when there is higher utilization.

HMS - Bring

Bring has started to use a new method to improve the working environment and safety for their employees and their impact on the environment, according to Maria Jönsson. The method is called HMS and stands for Health, Environment and Safety and has been initiated by the top management of Bring. Maria says that interest from the management has shown

to be the key for the method to be successful so far and the continuous work with HMS is top priority at the agenda at Bring. The unique feature with this method that separates it from many others, is that every employee is obligated to report a number of incidents every year. By having this pressure, the employees have started to actively search for things that could be dangerous or influence the work or the environment in a bad way. HMS has come far in the organization and Maria believes that it is a very good tool when it comes to improve the working conditions and the situations for the employees at Bring.

The philosophy behind HMS is according to Jönsson that if you do not have a goal or a method to measure a problem, the problem does not exist. By setting goals and measurement the problem gets visualized and you have a ground to start your improvement work from.

4.4 The view of the Triple bottom line

The respondents were introduced to the theory of sustainable development, generally referred to as the triple bottom line. The authors initially asked all the respondents if they had prior knowledge of the triple bottom line and sustainable development.

All the respondents were aware about the concept of sustainable development and its underlying pillars of environment, society and economy. Subsequently, the authors turned the focus onto freight transports and the relation between co-modality and sustainable development. The first round respondents were asked if the triple bottom line could be a possible way to assess co-modality. Stefan Back confirmed this, as all pillars are needed in order to reach an efficient and sustainable transport system. Back referred to the increasing attention towards environmental issues as a positive aspect, however he also states that the economical aspect is vital in every aspect, since it is the main driver. Furthermore, Mats Boll also supported the theory of using triple bottom line to assess co-modality by specifically mentioning competitiveness, social concern and environmental performance in relation to transports. Both Boll and Back though addressed the issue of lacking means of measurement in the environmental and social aspects, Boll specifically stated the challenge of quantifying aspects in a neutral way.

Åsa Aretun of VTI was also familiar with the concept of sustainable development, highlighting the necessity of including economic, environmental and social aspects.

4.5 Social part of the Triple bottom line

Respondents were asked what they regard as social aspects and issues in freight transport.

Stefan Back addressed the issue by stating that social pillar of the triple bottom line are the least discussed one in freight transport, especially in Sweden where much attention is paid towards environmental aspects in terms of emissions. However, Back stated the importance of it and declared it to be the least developed one of the three pillars. Back most of all referred to social aspects in terms of working conditions for people involved in transport

networks. He also explained the challenge of addressing these, as harmonization of rules for i.e. truck drivers are lacking in the European Union. This is rather handled on a national level where member states have their own set of rules.

Adding to working conditions, Back also mentions safety and security as social aspects of freight transport. In comparison to working conditions, these are well regulated. Safety and security are clearly distinguished according to Back. Where security refers to protection from external factors such as acts of terrorism, safety refers to issues related to the transport itself which could mean the protection of people involved in a transport flow.

Åsa Aretun initially claims social aspects in freight transport to be a complex issue, due to being multifaceted area. She categorizes social aspects of freight transport into different dimensions. The first one refers to social impact in external settings, how a particular transport flow affects the surroundings. The second dimension refer to the social aspects linked to the actual transport chain, where the human labor involved in the supply chain are concerned in terms of i.e. working conditions. Aretun further states that external issues allocated to transports, such as noise and human health, rather should be categorized as environmental issues rather than social ones.

Catrin Lammgård says that the description and focus on the social aspects to a large extent is based on how you choose to categorize them and how you chose to define them. In city logistics, the social factors are more interesting than in other transport situations, since the transports are closer to where people live. In populated areas you have a competition of space between for inhabitants and traffic. Lammgård states that according to her experience, there are more focus on the social aspect in cities compared to rural areas. She also believes that the future trend will be more focus on the socially related problems that transports causes. For new infrastructure solutions the social aspects are important, since the solutions often are permanent and not possible to change later on. One problem with the social aspects is that there exists no accepted universal methods to measure different social factors today. Hence they are not often included in cost benefit analysis in transport related development projects. As long as the measurement is lacking the account for social factors will be hard to do, according to Catrin Lammgård.

Social factors that Lammgård regards as important in relation to transports, are noise, accessibility, safety and land use. This is thoughts based on her earlier work in city logistics but she believes that these also could be seen as more general for all kinds of transports. The safety part is concerning the employees, such as truck drivers. For example, she mentions the risk of being assaulted as a problem in the working environment. The safety also concerns the general public from a traffic safety situation. The accessibility as a part of social aspects, is according to Lammgård mostly concerning personal transports in cities. For the land use perspective, transport solutions can cause barrier effects that limit social integration between different parts of a society and also visual intrusion should be important when assessing transport from a social perspective.

In this section, the respondents were asked more specifically about the social aspects in relation to freight transports. The authors tried to gain knowledge by asking respondents about the current situation in the freight market and how much the social aspects are considered in relation to transport flows.

The general response from the respondents were a shared opinion that social aspects are given less attention compared to economic and environmental aspects in freight transport and logistics. Åsa Aretun gave one possible explanation to this, by stating that the heritage of freight transport has been of a non-social nature. The main driver for freight transports have traditionally been economy. Environmental aspects have had a recent upswing due to the increased awareness of global warming and associated emissions, while social aspects have not received an equal share of attention. Aretun further reinforces this theory by the fact that transport business historically have been of a technical nature where humans are considered part of the transport flow to reach certain levels of efficiency, profit etc. rather than how humans are affected by freight transports.

The lacking attention towards social aspects could according to Aretun also include the power of the involved stakeholders. Where the voices of stakeholders such as retailers, carriers and transport buyers often reach coherence, the third-party stakeholders such as humans exposed to different social aspects related to freight transport do not have the same level of impact. This could be one additional reason why social aspects are somewhat neglected in transport flows.

Lasse Holm says that the social part of transports often is neglected. This is to a large extent based on the lack of focus on transports in many industry segments. Generally there is larger focus when low value goods are transported such as for example timber, since the transports stands for a large part of the total cost. With high value goods, it is the opposite. The lack of attention from transport buyers results in that the transport suppliers often ignore these issues. He also believes that social issues will be of more importance in the future, compared to environmental issues that could be seen as a hygiene factor today.

Mats Boll referred to the company policy which nurtures environmental and social values. When an actor is contracted for carriage of goods, Volvo implies environmental and social demands primarily in terms of CO₂-emissions and working conditions. However, Boll states the challenge when a carriage is subcontracted in several steps by a trusted carrier. The issue is the lack of control when a transport is carried out by an unknown sub-carrier, it is then a difficult task to make sure the set policies are followed.

Maria Jönsson of Bring Frigo states the same issue as Boll. Where the core company has a strict policy of CSR values, the subcontracted carriers are harder to monitor. Jönsson explains that Bring has a strict set of terms which their subcontractors have to follow. However, she states the issue of lacking control when a subcontractor appoints additional subcontractors for carriage.

Holm thinks that large companies both from industry sector and transport sector uses the subcontracting problem as a way to evade their own responsibility regarding social issues in the sector.

5. Analysis

This chapter will present the analytical part of the thesis where the theoretical and empirical findings are used in a discussion based on the research questions. This chapter will lay the foundation for the later on conclusions.

5.1 Stakeholders perception of co-modality

The nature of co-modality could be interpreted as hard to identify and could be viewed upon as a philosophy for transport improvements, rather than a model according to the authors. In the way that co-modality is formulated, it is possible to include everything and everyone within the transport sector, it also allows different stakeholders to interpret the concept in various ways. From one point of view, it is necessary for all stakeholders to be able to identify themselves within this philosophy according to the authors. However in another point of view the lack of boundaries could also be seen as counterproductive for co-modality, since it could be hard to understand the usefulness and the value of a co-modal based thinking. The interesting issue is to see how co-modality is understood and interpreted by different stakeholders and if there are differences depending on their role and relation to the transport sector. Figure 18 represents the respondents' answers and the stakeholder perception from a strategic, operational and scientific level where the general perception of co-modality is summarized for each level:

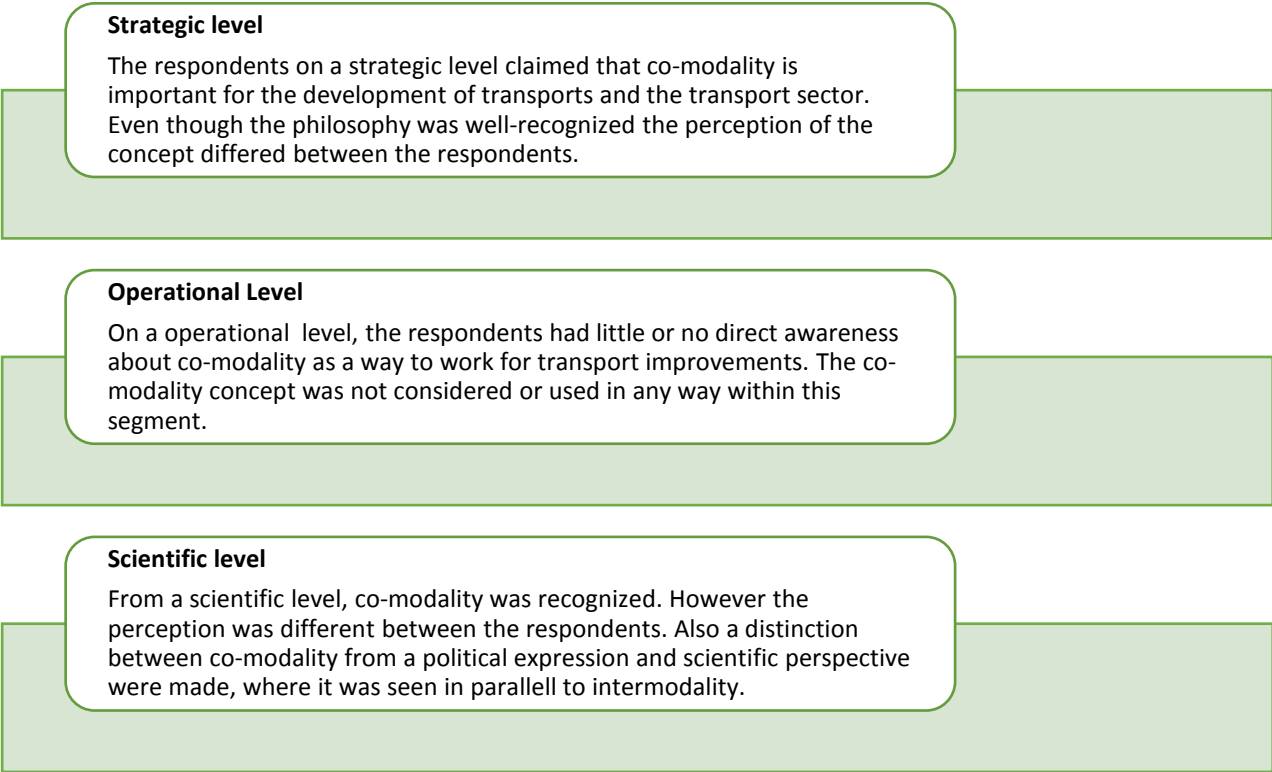


Figure 18: Summary perception of co-modality

As stated by EC (2006) in the theoretical framework, the co-modal philosophy was introduced as an instrument to handle and improve the development of the European transport system. The empirical result gives an indication that co-modality is more of a political statement, rather than a philosophy connected to the operational processes within the transport sector as seen from the respondents answers. The philosophy seems to be most important to the individuals that are involved in strategic processes rather than the operational activities within the transports. Even the respondents that claimed that co-modality is a useful way to develop transports, held different views of the true meaning of the concept. The problem to define co-modality is probably one reason for why the concept has had so hard to reach coherence and recognition by stakeholders that are outside the higher strategic sphere of transports, according to the authors. From a scientific standpoint, based on the respondents answers, co-modality is almost only seen from a policy perspective, while research to a large extent is connected to more narrow transport solutions, such as intermodality. The lack of available research on co-modality also confirms the disinterest of co-modality on a general level of the transport sector according to the authors.

5.2 The usefulness of co-modality

As discussed in the previous section of the analysis, based on the respondents' answers, co-modality is not that widely recognized in the transport sector and there is not much research conducted within the field. There are also large differences in the interpretation of the concept, which according to the authors could be seen as a failure of co-modality as a way to develop the future freight transport solutions. However, despite these weaknesses, the authors believes there are still several indicators that shed light to the discussion whether or not, the co-modal philosophy could be a way to contribute to a more comprehensive society wide view of transport and play a key role for the future, as illustrated in figure 19.

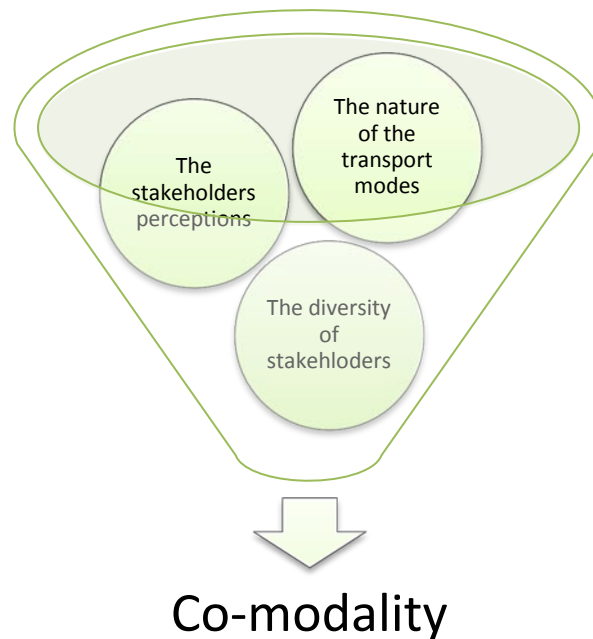


Figure 19: Usefulness of co-modality

5.2.1 The stakeholder perceptions

First of all, as seen in the empirical results of the research, the respondents from the different stakeholder segments had differing knowledge and perceptions of co-modality as a method or philosophy to improve transport processes. However, when the respondents had the opportunity to give their view on important steps and solutions for freight transport improvement, their opinions were very similar. All respondents stressed the importance of finding the potential that lies above the physical transport work. Instead of focusing on each mode or link by its own, they rather saw it from a system perspective, where the key factor is to develop solutions to get benefits and improvements to the entire transport system. In some cases this would imply intermodal/unimodal/multimodal solutions according to the authors, but none stated this as a purpose in itself; instead the final output of the solution was the important part for the respondents.

Cooperation was one important key to find these solutions according to the respondents. Not only from a view within the own organization, but rather as a way to find new solutions together with industry colleagues, actors from other industries and other parties involved in transports.

This common view of the transport sector as a system, corresponds quite well with some of the fundamentals of the co-modal philosophy. This is also in line with the authors' interpretation of the core of co-modality. From an analytical point of view based on the interview result, the authors think it is possible to argue that the transport sector in many aspects actually has a co-modal approach of development within the sector. The different respondents shared to a high degree the same fundamental ideas of transport development as found in the co-modal philosophy according to the authors, but not officially stated as a

strategy. This strengthens the authors hypothesis that co-modality could be a useful philosophy to improve transports.

5.2.2 The nature of the transport modes

Secondly, the individual characteristics of the different transport modes have a large impact of the potential usefulness of co-modality as a way to relate to future transport development according to the authors. As shown in the theoretical part of the research every transport mode has its own specific characteristic and is used both in a system with other modes but also alone. As described in the surface competition section by Trafikverket (2012), every transport mode has by nature their operation area and surfaces where they are competing with other modes. These borders are not constant and can be changed by both internal and external factors. Important to understand according to the authors is that there are many cases where a perfect substitution between transport modes does not exists and thereby the idea of just move freight from one transport mode to another not realistic.

From the view how different transport modes is used and including modal split, it is obvious that all transport modes at the moment has a place and from a development perspective it is rational that all transport modes also is considered when improvements are developed according to the authors. By dividing the factors of interest in the development of freight transport in economic, environmental and social dimensions is according to the authors possible from an analytical view to see their major differences and why and how all transport modes are important for the entire transport system to work.

	Road transports	Rail transports	Sea transport
Strengths	<ul style="list-style-type: none"> Flexibility Adoptability Speed Low handling costs 	<ul style="list-style-type: none"> Environment Economies of scale Capacity 	<ul style="list-style-type: none"> Environment Economies of scale Capacity
Weakness	<ul style="list-style-type: none"> Environment Congestion Traffic safety Work conditions 	<ul style="list-style-type: none"> Lack of infrastructure Different standards Low flexibility 	<ul style="list-style-type: none"> Speed Handling costs Land use Congestion in ports

Figure 20: Summary transport modes

Social

The social perspectives could be seen to involve both the infrastructural development, use of land and the geographical coverage of transport services. But also working conditions within the transport sector is an important issue. The rail infrastructure is today heavily congested as well as some parts of the road infrastructure. As a result there are difficult to increase the rail transport further on the existing infrastructure. For the aggregated transport system to be able to manage todays transport demands all modes in the system is important from the

social perspective. Also when it comes to geographical coverage which allows everyone to access the transport system is the versatility important, since infrastructural and geographical barriers exists for both rail and sea transport. The land use of transports is also a factor that influences the life of the general public. Ports in city areas are growing and causes difficulties in some regions, where the problems can be solved by combining transport modes in for example a dry port concept.

The respondents in the research were asked about how and if the company considers social aspects beside the obvious area of economy. Both Volvo and Bring were found to have extensive programs for corporate social responsibility. Bring place employee health and safety as core values, which prove a dedication to social values within the company. Volvo also provides an extensive dedication towards social and environmental values.

However, this paper does not intend to analyze the companies as whole, but rather the associated freight transport. A large portion of the transports carried out on behalf of Bring and Volvo is carried out by subcontractors. The appointed subcontractors may then on their behalf assign transports to another subcontractor. This allows for better efficiency in terms of i.e consolidation of goods and filling rate. Volvo puts strict requirements on their contracted carriers in terms of emission caps of CO₂ and decent working conditions. Bring, which appoints subcontracted carriers to 70 % of their transports, also put strict requirements on their conveyors in terms of different standards. However, it is difficult for the core companies to make sure their ethical and environmental requirements are fulfilled when a carriage is subcontracted in several steps. As pointed out earlier in the theory part of the paper is social factors like working conditions heavily debated in for example Sweden today. Stakeholders in the road sector claims that violation against cabotage rules and working conditions is a large and growing problem, which distorts the competition within the entire transport system. This issue of lacking control is something that Mats Boll, the representative of Volvo, admits. From this perspective is also a system that combines the different transport modes important to reach the social demands.

Environmental

From an environmental perspective of freight transport, it is according to the authors possible to see that both rail and sea transport has advantages over road transports when it comes to CO₂ emissions that is most debated today and one of the largest environmental problems connected to the transport sector. This is due to the scale factors that these transport modes have by nature. However to be able to get the volumes that is needed to actually get these advantages, road transports often a necessity. From this perspective the authors thinks it is possible to see that the entire system is important when you are talking about solutions and the role of the different transport modes involved. This is also a view that the research empirical result confirms where the respondents saw the system perspective as a key to further develop the different transport modes.

Economic

The economical perspective concerns mostly how well the transport system can respond and deliver the transports needed by a company or a region. The demand is not homogenous and there are several different factors that are important to be able to deliver. The transports should have the ability to be both flexible, have a high capacity, reliable and low costs. These different demands are not possible to meet by one single transport mode according to the authors, as seen when their different straightts are evaluated, instead the key is that the different modes are cooperating in a transport system where the advantages of each mode is utilized.

5.2.3 The diversity of stakeholders

Thirdly, the authors regard it important to highlight the diversity of co-modality and point out its ability to capture issues in the entire transport sector. In the empirical result of the research two widely different examples of improvements related to transport was presented. From an analytical point of view these are interesting since both could be viewed upon as co-modal processes according to the authors. The *train 8* case showed the importance of cooperation and system thinking to be able to optimize and utilize a train transport solution. The development success factor in this case lied almost entirely in the business model, where a system thinking and willingness to find new ways of working was the key. The *HMS* case on the other hand had an internal focus on safety and environment. The success factor was the involvement from the management and the new way of attacking the problem. Instead of waiting for accidents, they developed a proactive approach where they were actively searching for potential future accidents.

One interesting aspect with these cases is that both of them can be seen as co-modal improvements in different segments of the transport sector, however, still applied to the entire transport system. The philosophy to always try to optimize and improve all different parts of the transport system could be considered to be the basics of the co-modal philosophy.

5.4 The Triple Bottom Line and Co-modality

The concept of triple bottom line is a frequently recognized concept of sustainable development, as it covers all relevant areas. Browne et. al. (2010) provides a modified concept named sustainable logistics, where the three areas are linked to economic, social and environmental aspects of transport and logistics. This paper utmost concerns co-modality, thus the sustainable logistics model need to be adapted to freight transport. The definition of co-modality as "*the efficient use of different modes on their own or in combination will result in an optimal and sustainable utilization of resources*", allows for interpretation of the actual meaning of the term co-modality. As there is no definition to "efficient use of different modes", the authors sought to apply the concept of sustainable development to the concept of co-modality. By doing this, not only efficiency in terms of economy would be addressed, but also in terms of environmental and social factors. The

authors found this to be an interesting trial to examine whether the concept of sustainable development could be used to assess different transport solutions. During the initial stages of the literature review of sustainable development and transport, the authors found that the areas of economy and environment were extensively covered in research, literature, CSR-policies and business agendas. In contrast to this, social aspects were seldom referred to or highlighted. Upon this, the authors decided to put extra attention towards the social aspects linked to freight transport.

5.4.1 Social aspects of Triple Bottom Line and Co-modality

The interviewees were all professionals in the field of transport and logistics and provided valuable input to this section of the paper. By using the sustainable logistics model developed by Browne et. al. (2010) and questioning the interviewees about the most crucial aspects of the triple bottom line applied to freight transports, a few key aspects were commonly addressed and highlighted. What became obvious was that the several aspects were closely linked to one another and that some aspects could be categorized as economic, social or environmental. This proves that the areas are closely related to each other. The authors found that the only social aspect which is clearly separated from economy and environment, is working conditions for humans involved in the transport system. Besides from this aspect, issues such as health and safety could be sorted to either social or environmental pillars. This could also prove that some issues which are viewed upon as social concerns are not neglected, but rather categorized as environmental issues. Thereby, the authors initial theory that social aspects are almost non-existing in freight and logistics may not be entirely true.

However, regardless how issues are categorized, the social aspects related to freight transports are less developed compared to its environmental and economy counterparts. A possible explanation to this could be the inherited nature of transport, where the actual flow of goods has been the vital aspect and not how the transport itself has affected external circumstances. Due to increased awareness of global warming, the emissions linked to freight transport have reached great coherence. This has forced the transport industry as a whole to consider the external effects of emissions. This pattern of increased attention towards externalities derived from freight transport is likely to expand to other social and environmental areas. As seen in figure 21, the pillars differ in size as an attempt to illustrate how the focus of stakeholders to this study considers them.

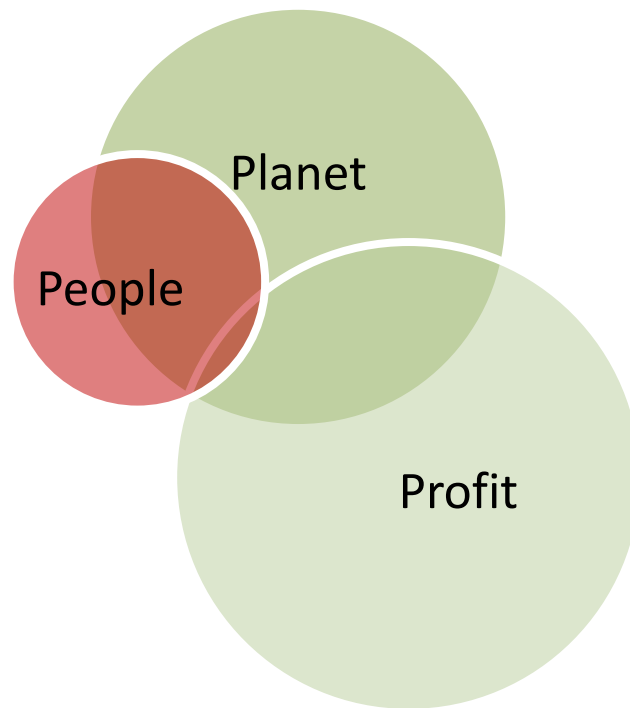


Figure 21: Triple bottom line – shaped by reality

Furthermore, the authors have found a difference between freight moving in urban areas, often referred to as city logistics, and freight transports passing through rural areas. The social/environmental aspects related to these different settings, differ somewhat. In densely populated areas, more people are exposed to external effects such as noise, safety issues and accessibility, in contrast to a rural setting. The voice of the third-party stakeholders is likely to be stronger when more people are affected by transport related social/environmental issues. With a growing population and more people moving to urban areas, the impact that freight transport implies on its surroundings in terms of external effects will most likely receive increasing attention in the future.

There are several occasions where economic, social and environmental interests coincides, aspects which provides a mutual benefit in more than one area. One example is fuel efficiency for vehicles. If a truck can be optimized to consume less fuel through i.e. eco-driving and technical improvements, both the environmental and economic aspects will benefit. However, there are situations where the different pillars of the triple bottom line clashes. The new emission control areas will pose a challenge among shipping companies operating these areas. Due to this papers European focus, the Baltic Sea will be subject to stepwise lowering of allowed sulfur content in bunker fuel. This will mean that a more expensive type of fuel will have to be used in order to comply with the new provisions. Subsequently, this will lead to higher transport costs for seaborne trade in the Baltic Sea area. In this case, the environmental and economic pillars are clearly not in tandem. Where the environment will gain from decreased sulfur emissions, seaborne trade in the affected

area will face more competition from other transport modes and a potential market-loss due to the increased costs. The authors found evidence for this by asking some respondents how and if the new SECA directive would affect their choice of transport. Clearly, these large-scale transport buyers is not unprepared for what is about to come and held several other transport alternatives as viable options if the cost of seaborne transports will rise significantly.

This proves that sustainable development within the freight industry is a complex issue, compromising between the different pillars seem to be inevitable and compromised transport solutions with society, environment and economy in consideration will probably the way which freight transport will have to be developed in the future.

5.6 Co-modality -Triple bottom line - Kaizen

Co-modality should have the potential to be seen as a transport parallel to Kaizen, which is an improvement philosophy that exists within production industries all over the world today. However, there are significant differences between Co-modality and Kaizen at the moment. First of all, the methods under the Kaizen umbrella could be seen to have a well-defined structure and rules how to be applied and used to constantly develop the daily work and processes, compared to Co-modality, which at the moment is a philosophy without any defined tools for improvements. Kaizen also provides with assessment and monitoring methods to evaluate progress, in contrast to the co-modality concept which lacks any kind of assessment criteria or alternatives of measure

Another significant difference is the differing origins between the two philosophies. In contrast to Kaizen, which was created in the factories by the people that worked with the processes, co-modality was created by politicians in the European Commission and has had problems to reach coherence among the different segments within the transport sector, as seen in throughout this research.

Freight transports will continue to have significant impacts on the entire society. Therefore, the co-modal philosophy is both of relevance and necessity for the development of the transport sector as discussed in the previous section of the analysis. However, for the ability to be useful, the authors believe that co-modality has to be connected to tools for improvements, compared to the same structure as that of the Kaizen philosophy which is discussed in detail within the theoretical framework. As seen in figure 22, the authors have created a structure to define the co-modal philosophy, where the triple bottom line is the central measurement. The triple bottom line concept could be a possible way to consider relevant aspects linked to freight transport. Some linked aspects may be hard to quantify and weigh against other aspects. Nevertheless, the authors would like to point out the need to consider and be aware of the linked economic, environmental and social aspects that associates with freight transport, regardless of mode. As evident when studying the surface of competition, all transport modes has their pros and cons.

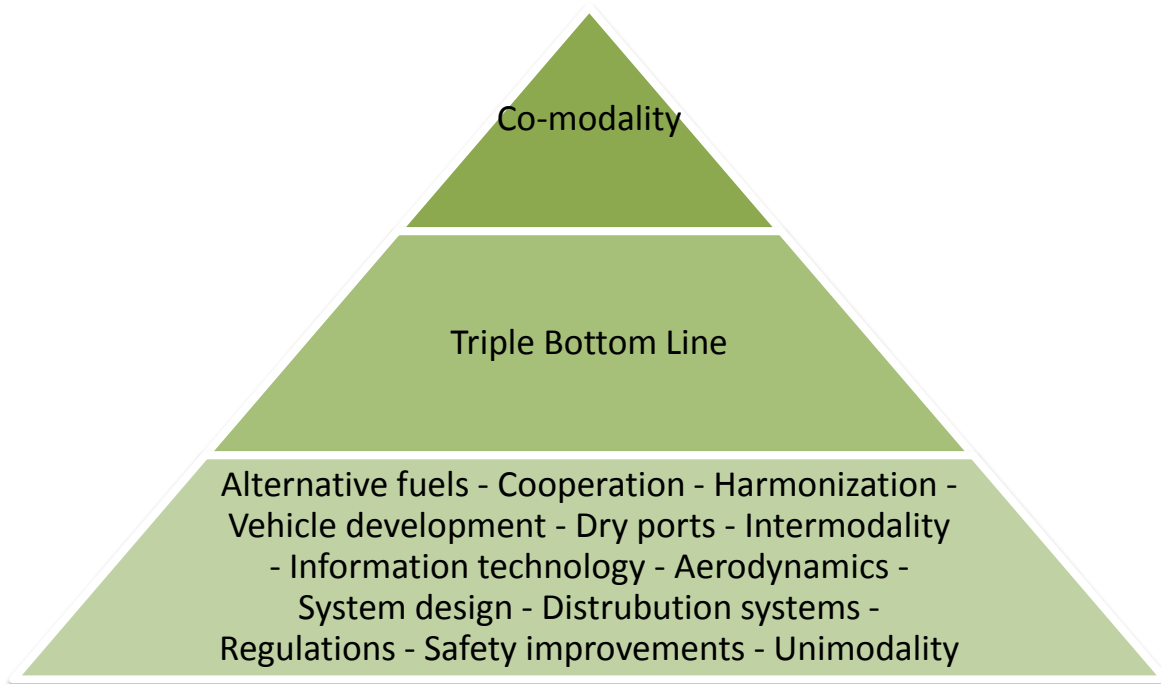


Figure 22: Structure of co-modality

Moreover, figure 22 represents an attempt to illustrate the connection between Co-modality, Triple Bottom Line and Kaizen. Similar to Kaizen, Co-modality could represent the philosophy of continuous improvements in the freight transport industry. The triple bottom line represents the performance indicator of freight transport from a sustainable development point of view, where the three areas of economy, society and environment represent the underlying pillars. The bottom of Figure 22 represents available examples of “tools” that can be used in order to improve the performance of freight transports. It considers all transport modes and related activities, both in combination and on their own, as long as the improvements is considered from all three areas of triple bottom line. This means that the tools should not only consider economic aspects, but also the environmental and social aspects.

By providing a structure with tools for co-modality, the philosophy should have the possibility to be able to expand to a useful philosophy that has a best practice approach for the entire transport sector, which could be seen as a possible equivalent to Kaizen in freight transport.

Co-modality includes all types of transport related solutions, as long as the solutions drive the development within the transport sector forward towards sustainable development. The focus is to solve a transport need in the best possible way, and not focus entirely on which traffic mode or method that is used. As seen in figure 21, several tools are presented; these are some of the different ways for improvements within the transport sector that has been presented in this research, both in the theoretical part concerning the different transport modes but also in the empirical part. However these are only examples for illustration

purpose. Many more tools exist and can differ depending on the situation. The important part is to have the structure to capture smart innovative ideas for development and to assess the implementation of them by considering possible economic, social and environmental effects related to the decision.

6. Conclusion

This chapter will present the conclusions from the research by answering the research questions and also give suggestions for further research within the field of co-modality and transports.

6.1 Stakeholders perception of Co-modality

The general perception of co-modality has shown to be widely different depending on who is concerned. While some know it from the policy initiative of the European Commission, others interpreted it to be equal to intermodality. This could be a sign that co-modality have not yet received a general recognition. This is mostly evident on the operational level, where co-modality seemed to be generally unknown. However, at a strategic and scientific level, co-modality seems to be more frequently recognized but with a slight difference in how it is interpreted.

Even the respondents that claimed that co-modality is a useful way to develop transports had different views of the true meaning of the concept. The problem to define co-modality is probably one reason for why the concept has had so hard to be accepted or used by stakeholders that are outside the policy sphere of transports.

From a scientific view, co-modality is almost only seen from a policy perspective, while available research to a large extent is connected to more narrow transport solutions such as intermodality. The lack of available research on co-modality also confirms the disinterest of co-modality on a general level of the transport sector.

6.2 The usefulness of co-modality

While the perception of co-modality seem to differ between stakeholders of transports, the view on how to improve transports were similarly shared between respondents. The importance of shifting from a narrow view of transports to a system perspective was stressed by several respondents. Also the aspect of cooperation between actors in the supply chain was commonly addressed by the respondents. The cooperative ideas also concerned ways to develop new solutions together with industry colleagues, actors from other industries and other parties involved in transports.

This proves that, despite knowledge of the actual meaning of co-modality, the opinions from respondents correspond to the fundamentals of co-modality as interpreted by the authors. This could prove that the actual term is of less importance and the way of thinking is the important matter. Therefore, it could possibly be concluded that there is a co-modal way of thinking among the respondents of this paper. This further supports that the philosophy of co-modality is a way forward to develop and improve transports.

6.2.1 Transport modes and co-modality

Co-modality promotes usage of all transport modes in combination and on their own. What has become evident is that all transport modes has their specific characteristics, advantages and disadvantages. The surface of competition illustrates this, by showing the importance of every mode in different settings. This helps to show that there are no perfect substitutions in some occasions and that a pure modal shift is complex and most likely not feasible. However, in some areas, the option to switch transport mode is possible. What can be concluded from this is that transport development should not entirely focus on pure modal shift, but rather focus on improvement of transport modes on their own, in combination, and support modal shift where it is beneficent.

6.2.2 The Triple bottom line and co-modality

The authors decided to add the dimension of sustainable development to freight transports and the co-modality concept. The triple bottom line is used to illustrate potentially differing interests of economic, social and environmental character, where freight transports are concerned. Through the literature review and empirical material, the authors have found the most vital aspects related to freight transport. The economic and environmental areas related to freight transport were found to be extensively covered in research, agendas and other forums, while the social aspects were found to be less covered. However, in some cases, traditional social aspects were categorized as environmental aspects which could be one possible explanation to why social aspects seldom are highlighted. This however, proves the close connection between the two areas of environment and society.

6.2.3 Social aspects of the Triple bottom line

The empirics and the authors own perception on social aspects of freight transport coincides and is rather clear. More attention to social aspects related to freight transports is needed. The inherited tradition of freight transports being isolated from such issues is slowly beginning to change and will most likely receive more attention in the future.

This is further reinforced by the current trend where more people move to larger cities. In densely populated areas, more people are exposed to external effects such as noise, safety issues and accessibility, in contrast to a rural setting. The voice of the third-party stakeholders is likely to be stronger when more people are affected by transport related social/environmental issues. With a growing population and more people moving to urban areas, the impact that freight transport implies on its surroundings in terms of external effects will most likely receive increasing attention in the future.

6.2.4 Challenges – Triple bottom line and freight transport

There are examples when the three areas of economy, society and environment mutually benefits from a certain aspect. Improved fuel efficiency is one example. However, there are also conflicts present. One current example is the new SECA directives which affect seaborne trade in the Baltic Sea. In this instance, environmental and economic interests are clearly separated, which has led to a massive debate and will likely have effects on the pattern of

transport in the affected area. This proves the complexity of balancing the three different areas of sustainable development within freight transport. Compromising between the different pillars seem to be inevitable and compromised transport solutions with society, environment and economy in consideration will probably be the way which freight transport will have to be developed in the future.

6.2.5 Triple bottom line as measurement of co-modality

The triple bottom line concept is being a possible way to consider relevant aspects linked to freight transport. Some linked aspects may be hard to quantify and weigh against other aspects. Nevertheless, the authors would like to point out the need to consider and be aware of the linked economic, environmental and social aspects that associates with freight transport, regardless of transport mode.

6.3 Co-modality - Triple bottom line - Kaizen

The final verdict on the thesis suggestion to combine co-modality with triple bottom line in parallel to Kaizen, is that it has proved to be complex. However, co-modality should have the potential to evolve from a generally unknown concept into a transport parallel to Kaizen. However, significant differences currently exist. The Kaizen philosophy provides methods, tools and a well-defined structure containing rules on how to be applied and used to constantly develop the daily work and processes, compared to Co-modality that at the moment is a concept without any defined tools for improvements. Kaizen also provides with assessment and monitoring methods to evaluate progress, where the co-modality concept lacks any kind of assessment criteria or alternatives of measure.

For the ability to be useful, the authors believe that co-modality has to be connected to tools and methods for improvements and ways of assessment and measurement, compared to the same structure as that of the Kaizen philosophy. The authors have created a structure to define the co-modal philosophy, where a triple bottom line model adapted to freight transport, is the central measurement. The triple bottom line represents the performance indicator of freight transport from a sustainable development point of view, where the three areas of economy, society and environment represent the underlying pillars. By also exemplifying a structure with methods and tools for co-modality, the philosophy should have the possibility to be able to expand to a useful philosophy that has a best practice approach for the entire transport sector.

The primary focus should be to solve a transport need in the best possible way, and not focus entirely on which traffic mode or method that is used. The important part is according to the authors, to have a structure to capture smart innovative ideas for development and to assess the implementation of them by considering possible economic, social and environmental effects related to the decision.

6.4 Suggestions for Future Research

Further research could include a detailed framework on how to implement a co-modal philosophy and to evaluate the potential strengths and weaknesses of the authors suggested idea to assess and measure co-modality from a triple bottom line perspective.

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8. Appendix

8.1 Appendix 1 – Interview structure

High light and define co-modality

What is your / your branch perception of co-modality?

What does co-modality mean and how do you understand it?

Do you see any parallels between kaizen and co-modality?

Triple bottom line

Which factor do you think are the most important concerning sustainable development within transports?

Which social factors do you consider to be important in relation to transports?

Why do you think that the social factor is neglected in favor for the economic factor and environmental factor within transports?

Do you see any conflicts between social, environmental and economic development?

What possible conflicts could exist between the three areas of the triple bottom line and vice versa, when do they support each other?

Transports and development

Who do you see as close stakeholders to transports?

Who do you see as all other stakeholders?

Do you have any example of successful developments within the transport sector?