Shared Situational Awareness between inland actors at Port of Rotterdam

Improving Shared Situational Awareness by means of a game session

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Summary

Inland transport is a crucial component for the gateway ports such as Rotterdam. There are different parties involved in the inland transport: forwarders, shipping line agents, shipping lines, sea terminals, inland carriers, etc. To operate effectively and efficiently cooperation and collaboration is required between all involved parties. The claim of this project is that the root of several problems occurring in the container flow can be explained by the low level of Shared Situational Awareness (SSA), the mutual understanding of each others operation which facilitates the decision making process. Literature suggests that level of SSA of the actors involved in the container flow can be increased by playing a serious game, game which focuses on a learning objective rather than on entertainment.

This project aims to increase level of SSA in inland transport at Port of Rotterdam by a means of the serious game. Based on the work performed during this project, the session is designed with a serious game as a key element. The target group are the decision makers of the barge operator, truck operator, container terminal and the forwarder, as they are directly involved in inland container transport. Game sessions shows the positive effect of increased SSA on the performances. Further in this chapter the summary of this thesis report is given.

Background.
During the initial analysis the structure of the inland transportation is revealed. The end-clients hire the transport organizers, who arrange all aspects of the transportation. The physical container transport is performed by the barge, truck and rail operators to the container terminal, from which the container is loaded to the sea-vessel. Many parties are involved in inland container transport, which differ in size and power. There are dozens of the truck operators and forwarders, while there are only a few container terminals which process the major part of the container traffic. Inland transport can also be characterized by the high inter-dependencies between the involved actors. The initial analysis of the container flow revealed the number of problems: process of obtaining berth time for barges, absence of information about the next transportation mode for the import containers, etc. The starting assumption of this project that the cause of these problems can be linked to the lack of Shared Situational Awareness. The involved actors perform as a set of independent companies with a fixed input and output, where the situation of the outside world is not seen as an important factor for their own company. According to the this assumption, to increase the performances of the inland transport the level of Shared Situational in the chain has to be increased. The preliminary analysis showed that serious game is a most promising tool to perform this task.

Research approach.
The objective of this research is To design a serious game to increase the Shared Situational Awareness in inland transport from/to the port of Rotterdam. Due to the dual nature of the objective the project work is split into two flows: SSA in the inland transport and game design. For each flow the main research question is divided into sub-questions. The schematic representation of these two flows and their inter-dependencies is presented in figure on top of the next page. To answer these questions three main methods are used:
desk research, the interviews and game design. For the process of the game design, a Triadic game design model is used three times: to filter different game concepts, to translate game concept into the working game and to finalize the game.

Theoretical framework.
The literature review is performed to verify the claims made in the objective of the research: the importance of the SSA in inland transport and capability of the game to increase the SSA. It is showed that SSA plays a role in the inland transportation. The game can be used to increase the knowledge about inland transport, also it can increase SSA. The analysis of the learning process showed that the positive effect from the game can be maximized if all the steps of the learning process are included: the designed game should be supported by lecture, discussion and post-game evaluation.

Inland Transportation.
The next step performed in this project is the investigation of the inland transport in more detail to analyze the current level of SSA. First step is to identify the actors, which have direct influence on the performances of the inland transport: organizers of the container transport, inland carriers, container terminal. From the inland carriers the rail operators are not investigated due to several reasons: small share of the containers transported by train, size and number of the rail operators, and fixed schedule. The actors are investigated by performing the desk research and interviewing the representatives from the industry. The objective of this study is to investigate the operations of each actor and to identify the problems that they experience. The former is used to make the game more realistic, the later to increase the learning effect of the game. The interviews are performed with one truck operator, two barge operators, one shipping line agent, and one forwarder. No contacts could be found with container terminals, however, container terminal is a popular topic in literature and the lack of the interviews is compensated by the extensive literature study.
The study revealed the details about the operations which take place at each actor. The list of problems in inland transport is derived directly from the interviews and from the analysis of the actions. Each problem is then discussed from the perspective of the Shared Situational Awareness: low levels of SSA are at the root of the problems occurring in inland transport. The analysis showed that communication plays an important role in increasing SSA.

Game Design Process.
The information gathered from interviews is used as an input in designing a game session. Game session is structured as follows: lecture on the SSA in inland transport and Games; discussion on the topic of SSA, description of the players, introduction to the game, game, game session debriefing.

Before the process of the game design has been started, the analysis is performed on two topics: the link between the reality and the game model, and which elements of the reality should be included in the game. Forwarder, truck operator, barge operators, container terminal are defined as actors which should be played actively. Other actors which have an influence on the container transport but not directly involved in the container flow are chosen to be passively implemented in the game. After that the problems due to the lack of SSA, which the transportation chain experience, are analyzed based on their added value to the game and a possibility of the implementation.

After the objective and the requirements of the game are defined, the process of the game design is started. It is performed in three rounds. In the first round 4 alternative concepts for the game are presented: quiz, board game, card game, and role game. The evaluation of the alternatives showed that none of the proposed concepts in pure form can reach the game objective. It is decided that the combination of these concepts has more potential.

In the second round of the game design process, the chosen concept is translated to the game, that is then built and tested. The test showed that the first version of the game did not satisfy the objectives. The feedback was used as an input for the second game version. At the end about 10 game versions were built, each an improvement of the previous version. The difference between the some versions concerned only minor aspects, three main game versions can be distinguished. The first version had very high reality factor, which led to the players not being able to understand the game mechanics and the game could not be played. In the second version the reality dimension is decreased: the second version was playable. However, several game aspects still needed to be improved. The third version of the game was playable and reached the objectives. This version is finalized in third round.

The next crucial aspect in a game session is a means of measuring the learning effect of the game. It is decided to use three different techniques: self rating, observer rating and performance measures. The self rating is based on the expertise of the game players, they are to share their experience about the game and its effect on SSA. Game master can also be used to evaluate the SSA, observer rating technique, he observes the game and notices certain aspects, after the game he makes the conclusions about the level of SSA. The last technique is linked to the game itself: in the game there is money involved and the objectives are given to the players, based on the success of the players in reaching these objectives, and the money spend during the game, the conclusions can be made about SSA. The results from all three methods are used to start the discussion on SSA in inland transport after the game.

Final Game Design.
The game session is led by a game master who has an extensive set of responsibilities:
• **organizational:** preparing the game session, inviting the players, preparing the presentation on the SSA in Inland transport, leading pre-game discussion, explaining the game to the players, controlling the execution of the game rules;

• **learning:** answering the questions of the players, analyzing the game process from the perspectives of SSA, evaluating SSA.

In the final version of the game there are 3 players: Container Terminal (CT), Transport Operator (TO) and Shipping Line Agent (SLA). Players have to execute orders and transport the containers between inland warehouse and sea-vessels. Each player has his own set of responsibilities: SLA receives the orders and arranges the paperwork, TO transport containers between terminal and inland warehouse, CT (un-)loads the sea-vessels and processes the containers from and to inland transport units. Money is linked to almost each activity in the game to increase the interest of the player in the game. The game is designed in such way that a player can execute his role without any communication. However, if the players communicate with each other, share their situation and thus have a higher level of SSA, the performances of the players increase. To make the difference clear between having low and high levels of SSA, game is divided into two phases:

1. Low SSA: activities of players are hidden from each other by placing a wall between the players and they are not allowed to communicate;

2. High SSA: activities of the players are visible to each other and the communication is allowed and stimulated.

During High SSA phase, problems experienced during the first phase can be relatively simply solved if SSA level of players is increased. The game is designed to show the positive effect of having higher levels of SSA.

**Final game tryout.**

During the design phase of the project the game is tested for several times with students of irrelevant for the project studies. The final tryout is performed at the end of the project with the representatives of the target group: container terminal, transport operator and forwarder. The game tryout showed that the game is playable, however at the beginning of the game players experienced problems with understanding the game mechanics due to the high complexity. When players started understanding the game, their interest in the game rose. In both phases of the game players could perform their activities, however in the High SSA phase problems and inefficiencies experienced in the first phase were solved by communicating between each other.

Three techniques are used to evaluate the players level of SSA: observer-rating, performance measures, and self-rating. First technique implies the use of the external observer, in the case of this project the game master, who observes the players behavior and makes conclusions about the level of SSA. In the second phase of the game players start collaborating and are able to perform their activities with less problems and more efficiency, which can be linked to the increased level of SSA. The increased performances of the players translates to the financial results, the players gain more revenues. The analysis of the financial performances of the players are used to evaluate the level of SSA, as performance measures techniques suggest. After the game the expertise of the players is used to evaluate their SSA, self-rating technique, by asking them to share their experience.
and the effect of the game on their SSA. Players noticed that the game is interesting to play and reveals the positive effect of higher levels of SSA. The results from all three methods are used to conclude that the game reaches the objective: to show the positive effect of having higher levels of SSA.

Game evaluation.
After the final tryouts, the game session is evaluated. The lecture and the discussion reached their objectives. The key element of the game session, the game should be evaluated from four perspectives:

- **Playability:** game mechanics are found to be complex, the players require to play the game for several minutes to understand the game mechanics. After they have learned how to play the game, they become interested in the game and concentrate on gaining revenues.

- **Meaning:** game shows positive effect of having higher levels of SSA.

- **Reality:** the game scores high on the reality dimension, most of the game aspects are based directly on reality or derived from the reality. To increase the playability several aspects are added to the game which are not backed up by the reality, however it is concluded that they do not have negative consequences on the objective of the game.

- **Requirements:** game satisfies most of the requirements posed before the game design process started, the requirements which the game fails to satisfy are minor and do not hamper the game learning objective.

To sum up the designed game session successfully reaches the proposed objective to show the positive effect of SSA on the performances of actors involved in hinterland container transport. It is playable and based on the reality. During the final game tryout the students of the logistics studies and new employees of the transport companies are identified as the best potential target group for this game. It is unlikely that more experienced employees will participate in the game as it takes 3 hours and no direct linkage can be made to the financial revenues for the companies.

Conclusions and recommendations.
The conclusions of this thesis project are:

- The low levels of Shared Situational Awareness in inland transport is at the root of several problems of the actors which play a role in inland transport.

- Inland transport as a complex adaptive system can profit from higher levels of SSA.

- Game is an appropriate tool to increase the SSA.

- To increase the learning effect of the game it should be supported by the lecture, discussion and post-game evaluation.

- Designed game session shows the positive effect of SSA on performances of hinterland transport.

The main recommendation to the industry is to Increase SSA. However, the companies do not feel the need for Higher levels of SSA. Designed game session creates an understanding
of such a need. Therefore we recommend to organize the game session described in this thesis. The recommendations for the future research are: 1) to perform the same work but for a different set of actors and interview more parties to establish the SSA of the industry in general and not only of its several actors; 2) to further investigate the link between communication and levels of SSA; 3) to measure level of SSA before the game, preferably in the long run, and after several months after the game is played to establish the long term effect of the game on the performances of the players; 4) to quantitatively measure the effects of higher levels of SSA and to propose the guidelines for the game design for Shared Situational Awareness; 5) to implement this board game on the computer.
Since the globalization started, the need for transportation has been constantly growing, it led to the development of larger ships, larger planes, and larger ports. The last one is the key component of the modern cargo network. The complexity of the ports has not only increased due to the size but also the factors such as increased number of actors, more centralized governmental regulation. Increased competition between ports has also played a role in making the processes at the ports less understandable.

Rotterdam’s port is the largest European port with total throughput of 434.6 million tons in 2011, which has risen up with 4.2 million tons since 2010 (Port of Rotterdam Authority, 2012a). In the report given by authorities of the port of Rotterdam (Port of Rotterdam Authority, 2011a) the global trends, which have the potential to influence the ports performance in the future, are translated into four scenarios for the performances of the port of Rotterdam by the CPB Netherlands Bureau for Economic Policy Analysis and the European commission (Mooij & Tang, 2003). The worst case scenario predicts the increase of the throughput for the Rotterdam till the 2020 followed by a slight decrease resulting in 475 million tons in 2030. Other scenarios predict a more bright future for the Port of Rotterdam(see figure bellow) (Port of Rotterdam Authority, 2011a). From the right part of this figure, it can be concluded that for all four scenarios the throughput of containers and break-bulk is predicted to increase at high rates, while other bulks will not show significant growth. Though the break-bulk showed the stable growth (5.5% in 2011 compared to 2010 (Port of Rotterdam Authority, 2012a)), it is excluded from the research, because its share is significantly lower compared to the containers: 123,556 tones for the containers versus 25,143 tones for the break-bulk (Port of Rotterdam Authority, 2012a).

Figure: Throughput expectations for four scenario: left total throughput; right throughput per type of bulk (Adopted from (Port of Rotterdam Authority, 2011a)).
The importance of the transshipment ports cannot be underestimated (Centre, Forum, for Economic Co-operation, & Development, 2009), however Port of Rotterdam remains a gateway port, nearly 75% of containers are from/to hinterland (Port of Rotterdam Authority, 2012b). The transshipment hubs experience low competition due to geographical location. The gateway port experiences extreme competition (Centre et al., 2009) due to almost negligibly small difference in shipment rates to different destination within the same region compared to overall costs of transportation for long-sea cargo’s. The hub ports focus on an increasing the efficiency of the sea-side, but in the case of the gateway ports improving services for shipping lines is not sufficient. To remain competitive PoR needs to have competitive hinterland connections.

**SALOMO Project**

This thesis project is a part of SALOMO project, which addresses the Situational Awareness for Logistic Multimodal Operations in container supply chains and networks. The aim of SALOMO project is to increase the performances of the hinterland connections from and to Port of Rotterdam and the container terminals at the Port of Rotterdam by increasing Shared Situational Awareness. Longer and more complex supply chains become less visible and more vulnerable to disturbances. Personal which is aware about situation, problems, operations, events, etc. of all other partners in the chain can deal better with everyday problems and any kind of disruptions. The focus of the SALOMO project is on the following challenges of the container transport (Verbraeck, 2013): uncertainties, variations, increasing demands for performance, and an improved degree of quality. Within this project several tools will be developed in order to facilitate the decision making process.
This chapter gives an introduction to this project, which focuses on designing a tool to increase the Shared Situational Awareness in inland container transport from and to the Port of Rotterdam. First the sea-container transport is presented. This is followed by the discussion on the inland transport. Several problems of inland transport found in literature are presented, the root of these problems has been shown to be the lack of SSA. At the end of this chapter the problem statement is derived and the structure of this thesis report is presented.

1.1 Container Transport

The container made transportation cheap, fast and easy (Levinson, 2006), however the sea container transport remains a complex topic. In this section the basics of container transport are presented by giving a simple example.

The cargo is manufactured at a factory somewhere in Europe. It has a buyer which is situated in the USA. The goods are not highly valuable, thus the sea-transport is a logical choice. The goods are stuffed into a container and transported by truck to the sea-terminal. If possible intermediate step can be introduced: barge or train. At the sea-terminal it is loaded onto a sea-vessel heading towards the container terminal in the USA, from which it is delivered to the receiver of the goods by truck (or combination truck plus train/barge). The goods are further unloaded from the container and, for example, sold in local stores. The described chain is illustrated in Figure 1.1.

This simple chain is complicated by several factors. A factory in Europe does not produce containers. The goods and empty container must be brought to the stuffing center. The same is true for the receiver, he does not buy a container and does not need it. When the cargo is unloaded from the container, after de stuffing the empty container is brought to the container depot in the USA. The trade balances between countries are not equal, and some countries (like China) export much more than they import, while other’s import exceeds export (like USA) (OECD, 2005), what leads to the exporters experiencing the lack of containers, while importers store the containers. This causes the empty containers being shipped back to the exporting countries, which increases the total cost of transportation.

![General model of the container transport.](image-url)
The transport between the sender and the receiver is performed in general by multiple companies. In presented example, the following parties are involved: European truck operator (or combination with barge or train operator), the sea container terminal in EU, the shipping line, the container terminal in the USA, the US inland carriers. In general neither the sender of the goods nor the receiver have knowledge about all parties involved in the transport. Additional party is introduced: companies which specialize in organizing transportation. They have expertise in the transport possibilities, have contact with domestic carriers, shipping lines, have expertise to arrange all needed paperwork, etc. This role can be fulfilled by one party, however it is not unusual that multiple actors are involved: customs brokers, forwarder, shipping line agents, etc. Besides physical carriers, organizers and end-clients, governmental and financial institutions are also involved to some extent in transportation. The performances of the sea-container transport depend not only on the individual performances of each actor, but also on the cooperation, collaboration, communication between these parties due to the high interdependencies between them. The same holds true for the inland transport, which is presented in the next section.

1.2 Inland Container Transport

The focus of this project is Shared Situational Awareness (SSA) in Hinterland Transport of the Port of Rotterdam. The terms inland transport or hinterland transport are used in this thesis to described the transport from the point in the logistic chain where the export goods are stuffed into the container till the export container is prepared to be loaded onto the sea-vessel and in the reverse direction for the import containers. In this section need for higher levels of SSA in inland transport is pointed out. The discussion starts with actors involved in the transportation and their problems.

In the physical flow of the containers two main parties are present: container terminal and inland carriers, which can be further divided into barge, rail and truck operators. In general, both container terminal and inland carriers do not work with the end clients of the transportation. The main client for the container terminal is the shipping line. The inland carriers are booked by the shipping line agents or forwarders. Both of them are responsible for the organization of the transportation, including the paperwork.

One of the major parties in the transport from and to the port is Customs. The import containers cannot be transported from the container terminal if Customs have not released the containers. Also many terminals do not permit the entrance of the containers from hinterland if the Customs documents are not in order. The financial group is involved in the inland transport, but its involvement in inland transportation is general and can be excluded from the discussion.

Physical flow of the container remains the same as presented in Figure 1.1. However, the information flow needs elaboration. A single client, who wants to transport the container is taken as a basis. While it is not rare to have goods of the several end-clients in the same container, after the consolidation it can be seen as one cargo and the party which ships the stuffed container can be seen as the client for the inland transportation.

The clients can work either with the shipping line agent (arrow 1 in Figure 1.2) or the forwarder. In case of the shipping line agent (SLA), SLA books the needed capacity for the containers in the most convenient sea-vessel (2). Documents must be provided to the sea terminals (3) and to the Customs (4). The shipping line contacts the terminal constantly before the departure and during the (un-)loading (5, 6). SLA makes an appointment with
the container depot (7) and the place where the goods physically are or must be delivered to (8). He arranges the inland transport (9). Inland carriers check the status of the sea-vessel at the container terminal (10), they also need to know the Customs status (11) of the container to transport the container from the terminal (12) to the Goods location (13) or in the reverse direction. Thus, the carriers contact the Customs (mostly indirectly via port services but we make a simplification in this example).

Instead of shipping line agent, forwarder can execute the organization of the transport (14), the forwarder needs to contact all the parties mentioned above (15-18). The interaction with the shipping line and the depot goes through the shipping line agent (19). However, the inland carriers still need to communicate with the SLA (9) to check the status of the container at the shipping line.

The described interactions (summarized in Figure 1.2) are given as an illustration of high inter-dependencies in the process and can vary for different ports and shipping lines. This high degree of interdependence is at the root of many problems which cause inefficiencies and ineffectiveness in the whole chain. the next section discusses several problems of the chain found in the literature.

### 1.3 Problems in inland container transportation

Ottjes, Veeke, Duinkerken, Rijsenbrij, and Lodewijks (2007) analyze the typical issues related to container-terminal. They argue that in the typical terminal all activities are concentrated around the deep-sea vessels. It means that unloading and loading of the ships have a higher priority over the other activities, they call it push and pull. Pull means that upon arrival, a ship pushes the containers it has to the terminal and then pulls the containers, which are waiting for the loading. At APM Terminal at the port of Rotterdam, this push and pull can be seen in the timing constrains imposed by the terminal operator (APM Terminals, 2012): all of them are derived from the arrival time and departure time of the vessel. The speed at which the vessels are (un-)loaded primary depends on the number and capacity of the available deep-sea quay cranes and the sea-side equipment. In case of a lack of the latter the resources from the land-side equipment can be shifted to sea-side.
This can result in slower processing speed of the inland transport and cause the significant traffic congestions at the gate-in of the container terminal (Maguire, Ivey, Lipinski, & Golias, 2010). The truck operators suffer the from this the most. However, it also increases the total transportation time, which is not in favor of the end-clients. The barges are processed at the same berth as the sea-vessels. However, as mentioned above the shipping lines are the only clients of the container terminals, which results in the barges having much lower priority for the container terminal. The berth time which the barge operator receives can significantly differ from the requested berth time (Andel, 2007).

Not only the inland transport is experiencing the problems. Steenken, Voß, and Stahlbock (2004) argue that 30-40% of the export containers lack the accurate data for the respective vessel, discharge point or the container weight. The import containers are a cause of even more inefficient stacking, the land-side transportation mode is only known in 10-15% cases at the time of unloading of the vessels. However, in most cases the customer knows the end destination of the container and has already booked the next transportation mode, but the container terminal is not informed about that.

Other problem found in literature is the wrongly declared weight of the containers (FTA, 2011; IMO, 2012). The shippers fail to declare a right weight of containers and during the transport to the container terminal it was not noticed. The handling equipment may breakdown due to the over-weighted containers. The export containers are stacked in such a way that heavier containers are placed on top. However, the containers have limited strength. Thus the faulty declared weight of the containers on it can smash the container on the button of the stack.

In all these problems, the party, which causes the problem (often without realizing it), differs from the party which experiences it.

1.4 Shared Situational Awareness

Overall efficiency and effectiveness of the inland transportation can be improved by the extensive information exchange. However, each actor is an independent organization and has its own agenda. Factors such as privacy concerns, rivalry, legislation, secrets about long and short term strategies, fear of opportunistic behavior, etc. hold the actors from information exchange. These factors enclose the involved actors in boxes which have fixed inputs and fixed outputs. Often no or insufficient information is exchanged between the actors except the basic interaction required for the correct order execution. In many cases there is no understanding why certain information is needed for other actors and where it can be used. The literature defines this as a lack of Shared Situational Awareness (SSA) between the actors involved in the container handling.

The main idea of SSA concept is that if the actors in the system are aware about the situation of other actors, the whole system acts more efficiently. The actors causing certain problems are not always aware about the consequences of their actions and if the actor is situationally aware he can adjust his behavior accordingly. This concept is not new and it has been studied in aviation and army for several decades. However, the main difference between the hinterland transport and the common fields of Situational Awareness research is the absence of the hierarchy in hinterland transport. All the companies are independent and no regulations can be dictated from above in order to increase the performance of the whole system.

Thus the actors involved in hinterland have to understand the need for SSA. For this
reasons it has to be pointed out to them that certain problems are caused by the lack of SSA, also the positive effect of increased SSA has to be shown. The simulation game can be used in order to execute these tasks. Properly designed it can not only present the problems associated with the lack of SSA, but also test in the safe environment new policies based on the increased SSA.

The aim of this thesis is to design a game session which is capable of increasing Shared Situational Awareness in inland transport.

1.5 Thesis Structure

This thesis is structured as follows:

- Chapter 2 explains the research methodology of this project. In this chapter objective of the project is defined and translated to the research question, which is further divided into sub-questions. The whole organization of the project is presented and the methods used in this project are discussed.

- Chapter 3 gives a theoretical foundation of the topic of Shared Situational Awareness and how to increase it in inland transport. The chapter starts with the topic of Situational Awareness. After that the inland transport is discussed as a complex adaptive system. The next topic discussed in this chapter is a means to increase the knowledge about such systems, and it shows that the game is one of the most appropriate tools. It can be pointed out that to maximize the effect of the game, it is necessary to use all parts of the learning process, not only the game. Further discussion shifts to the games and their applications.

- Chapter 4 discusses the inland transportation in more detail. First the actors involved in transportation are discussed and classified. It is impossible to increase SSA of all the parties in the transport, thus the focus is narrowed down to certain actors, that suffer the most from the lack of SSA in the chain. Each actor is described by presenting the procedures for their operations and everyday problems they experience. These problems are analyzed from the perspective of the SSA.

- In Chapter 5 the process of designing a game session to increase SSA is presented. The work is focused on the game design as a key tool, other elements of the learning process such as lecture and discussion are used to support the game, they receive minor attention. The chapter starts with discussion on the elements of the reality which should be included in the game. After that the game objective and game requirements are imposed on the final design. This is followed by the discussion of the evolution of the game versions from unplayable to the game which is capable of increasing SSA.

- Chapter 6 presents the final game design and the structure of the whole game session. The main game principles and the reasoning for design choices are explained. The chapter shows the role of the game master and presents the guidelines for his work.

- Chapter 7 discusses the final tryout of the designed tool. The results obtained during this tryout are used to evaluate the game.

- Chapter 8 makes conclusions and gives recommendations.
This chapter presents the research framework of this project. First the objective of the research is derived from the problem statement defined in Chapter 1, which is translated into the main research questions. In order to find the answer to the main questions, it has been divided into sub-questions. Based on this sub-questions the research is split into phases. At last in this section discusses the methods used for each of the phase of the research.

2.1 Research objective

In Section 1.4 the problem statement is presented. It should be remarked that the party that causes the problem almost always differs from the party that experiences the problem. None of the actors can solve his problems independently. One can assume that the party causing the problem is not always aware of the consequences of its actions. Principles of Shared Situational Awareness (SSA) (P. M. Salmon et al., 2008) argue that the system performance can be improved in case of more awareness of the actors of the situations of each others. Coming back to the container terminal as an example, the container terminal could improve its efficiency if the intentions of shippers were known upfront. However if the shippers are not aware of the working principles of the container terminal, they would not feel a need to share the information about the next transportation mode.

To increase SSA it is not sufficient to explain what the consequences of their actions are to the decision makers of the companies, it is important to let them feel the need for shared situational awareness. The inland transport can be seen as a complex adaptive system (Kurapati et al., 2012). The understanding how such system works can be brought about by playing serious games (Bilsen, Bekebrede, & Mayer, 2010). Properly used, this understanding can be translated into increase of SSA. Although the computer games give a lot of opportunities to enhance the learning process, it is not feasible to develop the complete computer game within given time and the board game is seen as a possible solution. The main objective of this research is defined as

*To design a serious game to increase the Shared Situational Awareness in inland transport from/to the port of Rotterdam.*

The next crucial aspect which requires attention is the relevance of this research to the academic and managerial communities.

2.1.1 Scientific relevance

The Shared Situational Awareness has been the subject of intensive research at different fields, mainly the military, medicine and air control. However there is a lack of research on the SSA between independent parties. This research investigates the existing problem of multi-actor interaction from the perspective of the Situational Awareness. After the series of
similar researches, the gathered results might be subsequently generalized to new theories. At the same time the process of the development of the game which is able to increase the SA can also be used as an input for the researches which are looking for the guidelines to improve the SA.

2.1.2 Managerial relevance
Managerial relevance is more obvious than the scientific. Even now the main objective of the most of the companies is the increase of performance. The time spent in negotiations, waiting time, the money spent for an extra-day at the storage due to some unpredicted actions of the third players, are always a targeted for elimination for the business managers. Thus, every small step which can improve the chain performances is relevant for managers. Increased Shared Situational Awareness among the players involved in the inland transport of the containers from/to port of Rotterdam will give actors more insights in the activities and interests of each other, making a ground for better information exchange. The ultimate goal is to influence the behavior of involved actors by letting them play the developed game.

2.2 Research questions

The research aims to increase the Shared Situational Awareness of the actors involved in the inland transport from/to the port of the Rotterdam by playing a game. This objective is translated into the research question which will guide the research:

*How can SSA in PoR hinterland transport be increased by the use of a serious game.*

This question is broad and complex, and has two main parts: SSA in the inland transport and game design process. Due to a contrasting nature of these two topics, the project is split into two flows: SSA in inland transport and game design. Having two flows does not mean that they are independent: the outputs of one flow are used as an inputs for other flow. Next in this section the global overview of the phases and flows illustrated in Figure 2.1 is presented, followed by the sub-question per phase.

**Flow One: SSA in the hinterland transport.** In the first phase the literature review on topics of Shared Situational Awareness and Inland transport is performed. The outputs of these blocks are used to prepare topics to discuss during the interviews (arrow 1 in Figure 2.1), to link the proposed concepts to the Inland Transport (2) and to choose the most appropriate concept (3). The topics for the interviews are used as a guideline during the interviews (4). The analysis of the data from the interviews is used to identify the learning objectives of the game and to increase the realism of the game (5). Also the data is used in the third phase to finalize the game (6). The sub-questions for this flow are presented in the lower part of Table 2.1.

**Flow Two: Game Design.** The literature review on the topic of the Games in Game Design flow is used as an input for identifying possible concepts for the game (7), to adjust the interview topics (8) used during the interviews, to explain the goal of the research and to ask for possible comments on the game (9). The proposed concepts are evaluated based on the information from the literature review and if not satisfactory new concepts are proposed (10). If 3-5 concepts that have a potential to reach the game objective are found, the project goes to the second phase (11), where these concepts are evaluated and one is
chosen. This concept is further detailed to the prototype (12). It is expected that the first prototype will not fulfill the objectives of the game, it is adjusted together with the data from the interviews (13). When the prototype satisfies the objectives the project enters the last phase (14), during which the prototype is finalized to the end product, the iterations are also expected in this phase (15). The sub-questions for this flow are summarized in the lower part of Table 2.1.

### 2.3 Research Methodology

The analysis of the research sub-question showed that three main methods are required to answer them: desktop research, interviews and game design. The effect of the designed game on Shared Situational Awareness should be measured, however, no universal methods exist to measure it and further investigation is required. Thus, the methods used for measuring SSA will be discussed as they are discovered. This section explains the use of three main methods, also the expecting difficulties associated with this methods are discussed.

#### 2.3.1 Desktop research

In the first phase of both flows the background information is gathered. For both flows this is performed to understand the basics of the container transport and to identify the topics required to be discussed during the interviews. Also SSA and the working principles of SSA are investigated by the means of a desk research.

The following aspects can be disadvantages of a desk research:

1. Results may be out of date
2. Results may be incorrect

Figure 2.1: Research structure. The solid lines mean the direct interaction between blocks in the direction of the arrows and the dotted lines are used as a scoping factor for the work performed in particular blocks.
Table 2.1: Research sub-questions for two flows of the research.

3. The amount of information available may be very limited

The last problem will probably have the biggest influence because the private organizations are not keen to publish their problems and the causes of these problems in the public domain.
2.3.2 Interviews

In the second phase of low Hinterland Transport the interviews are held with the representatives of different actors involved in the container flow. The focus of the questions is on the procedures of the actors, their interests, inter-dependencies, information required from other parties, privacy concerns and corporate secrets which stop the extensional information exchange. The gathered data is used to understand the container flow in hinterland transport and to evaluate SSA of the involved actors. Also the interviews are used during the game design to increase the realism of the game.

To conduct the interview the protocol is made according to Yin (2003). Yin (2003) distinguishes five levels of questions, which are presented in Table 2.2. For the interview protocol in this research only level 1 and level 2 are relevant. The interviews will be semi-structured in order to allow the topics which are not originally included in the interviews protocol to be discussed.

Different techniques exist to analyze the qualitative interviews (Folkestad, 2008; Schutt, 2011): backing up each statement derived from an interview with a quote, data reduction, iterative analyses, data displays, conclusion drawing/verification, etc. Due to the time and resource constrains no more than one or two interviewees can be found for each actor. Schutt (2011) suggests to use iterative method for single-case analysis.

There is a number of limitations associated with the interviews. It can take a significant amount of time to find the right interviewee, and in such cases the dependence of the research relies heavily on the participation of a particular person. The interviewee might not be honest during the interviews. The first problem is difficult to tackle because some of the researches have very rare or not popular for the conversation objectives. However, it is not expected to have this problem because of a high number of different parties involved in the container terminal activities. The second problem can be resolved by the extensive planning, and trying to establish good relations with the interviewee by the use of multiple meetings, and recommendations from trusted persons.

2.3.3 Game design

The game is designed in the second flow of the project. The waterfall approach proposed by Duke (1980) is extensively present in the literature, and despite the thirty years since its development, it is still used (Vries, 2008). However, the objective of this research is to increase the SSA, which demands a more agile approach. Triadic Game Design development model presented by Kortmann and Harteveld (2009) is used in this project. The model is illustrated in Figure 2.2. The name of the model is based on the fact that game has three

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Questions asked of the specific interviews</td>
</tr>
<tr>
<td>Level 2</td>
<td>Questions asked of the individual case</td>
</tr>
<tr>
<td>Level 3</td>
<td>Questions asked of the pattern finding across multiple cases</td>
</tr>
<tr>
<td>Level 4</td>
<td>Questions asked of entire study</td>
</tr>
<tr>
<td>Level 5</td>
<td>Questions asked of normative questions about policy recommendations and conclusions, going beyond the narrow scope of the study</td>
</tr>
</tbody>
</table>

Table 2.2: Five levels of interview questions (Adopted from (Yin, 2003).
Figure 2.2: Adjusted Triadic Game Design development model (based on model presented by Kortmann and Harteveld (2009)).

Figure 2.3: Game Design: Round 1

dimensions:

1. Reality: serious games are a representation of a real world. The reality component determines whether the game is realistic or not, which has a direct consequence for the success of the game.

2. Meaning relates to the effect that has been achieved by playing a game. For serious games, besides the game experience, such goals as learning process and encouraging communication must be included.

3. Play: this component determines the interactive part of the game: rules, actors, resources, story, etc. It makes the game attractive to play and supports the meaning component.

As illustrated in Figure 2.2 the model consists of five stages with three points for control whether the product still fulfills the game objectives. The initial model is slightly adjusted by adding the dotted lines in order to enable the feedback loops to multiple model nodes and replacing the Check by Evaluation. During the research this model is used three times: to choose from the alternatives concepts, to design a game, and to fine-tune the game.

In the first round different concepts are proposed, one concept is chosen as illustrated in Figure 2.3. In the second round the chosen concept is translated into the game design. Figure 2.4 represents the phases of this round. In the first check the proposed design is evaluated, if satisfactory, it is physically implemented and played. The last phase is the evaluation of the game by evaluating the game scores on playability, reality and meaning factors. If the results are not satisfactory the analysis is made to identify the phase where it went wrong and the Game Design returns to the phase that caused the problem.
In the third round the game is finalized for the tests outside the working group. The results are evaluated and if needed the necessary adjustments are made to the game. The output of this round is the game ready for the deployment. However, the deployment phase lies outside of the scope of this project. Thus passing through this round means the end of the project.

The last thing which requires attention is a means to evaluate the game. The game has to contribute to the research objective of this project, more detailed objective for the game is defined based on the performed interviews. However, as presented in the model, game has three dimensions: Reality, Meaning and Playability, meaning that a serious game MUST be real, meaningful and playable. The criteria for evaluating these dimensions has to also be defined before the start of Round II of the game design.

## 2.4 Activity Flow

Research structure presented in Figure 2.1 is used to make a flow of all the activities performed during the execution of this project. This flow is presented in Figure 2.5. The inter-dependencies between the activities are shown together with the decision making points. Besides the steps mentioned earlier, the activities associated with the project execution are added: project proposal, thesis writing, green light meeting, defense.
Figure 2.5: Activity Flow
Previous chapters claim that inland transport performances can profit from increased Shared Situational Awareness. In the section 3.1 and 3.2 the principles of the Shared Situational Awareness are explained. In section 3.4 the inland transport is discussed from the perspectives of the complex adaptive systems. Section 3.3 discusses the importance of the SSA in the complex adaptive systems. In section 3.5 it is shown that SSA can be increased by playing a serious game. Further in this section the following aspects of the serious games are presented: history, place in the educational process and what they are. The chapter closes with the discussion on the ways to evaluate the SSA. These steps correspond to the first phase of both flows as depicted in Figure 3.1.

3.1 Situational Awareness

Originally term "Situational Awareness" comes from American military aviation, but during last decades it has successfully immigrated to academic fields. Nowadays doctors have to be situational aware during the operation, business executives should be able to predict the behavior of the rivals and to adjust their actions to this prediction. The literature gives different definitions to Situational Awareness (Stanton, Chambers, & Piggott, 2001), however they all agree on the main focus. For the purposes of this project the definition of Situational Awareness mentioned by Tadda and Salerno (2010) is modified:

\[ \text{Knowledge and understanding of the current situation which promotes timely,} \]

Figure 3.1: Research Steps: Theoretical Framework.
relevant and accurate assessment of operations of all involved actors, within the container handling in order to facilitate decision making by providing the decision maker with the projection of the future situation.

Any activities of actors involved in hinterland transport can be understood under word "operations": decision when to book the transport, booking of the transport, transporting the containers, processing them, informing the parties about some events.

There are three main theories on the Situational Awareness (Stanton et al., 2001): the information processing approach, the activity theoretic approach, and the model of the perceptual cycle. According to Stanton et al. (2001) all three theories are based on general models of human cognitive functioning.

M. R. Endsley (March 1995) suggests the Model of SA in Dynamic Decision Making (in Figure 3.2 the model is illustrated). The model shows the place of the SA in the decision making, it precedes the decision making and the performance of the actions. According to the model, SA is influenced by two type of factors:

- individual: goals and objectives, preconception and expectations, abilities, experience, training
- systematic: interface design, stress and workload, complexity, automation.

State of the environment is used as an input for the SA. The model shows that the Situational Awareness consists of three levels. The first level Perception is fundamental. Without the perception of important information the situation cannot be understood completely (M. R. Endsley, 2000): anticipation of the current situation, seeing and monitoring right things in the certain situation. At this stage Endsley does not presume any information processing activities. The second level is the Comprehension. To successfully understand

![Figure 3.2: Model of SA in Dynamic Decision Making (adopted from (M. R. Endsley, March 1995))](image-url)
the situation not only the right information is needed, but the ability to integrate the perceived events into valuable analysis for the actors. Results of previous researches presented by M. R. Endsley (2000) show that 76% of SA errors in pilots can be related to level one, and 20% to level two. The last and the highest level of SA is the Projection: the ability to derive the future events from the current situation.

The distinction made in the definition between SA and decision is emphasized in the model. It means that having deep SA is not directly translated into the positive results from the decision making process. Knowing what the opponent will do next, cannot help if the decision maker is lacking the analytical skills.

The next step Performance is separated from the SA and Decision Making. Even if an army general perfectly observes the current situation, integrates it into the valuable analysis, projects the consequences to the future, it is not only the decision making that can go wrong. The right decisions can be poorly executed due to the lack of training of the field soldiers. The same holds true for the doctors, if they cannot perform the operation properly, all the activities preceding the operation, including the taking of analyses, combining gathered information together, concluding the right diagnoses and prescribing the proper treatment, become useless.

Bedny and Meister (1999) propose a different model describing SA, the activity approach. The theory assumes that individuals have goals that represent the ideal image of what they what to achieve; motives that push them towards accomplishment of the goals and actions that are needed to achieve the desired goals. The difference between current situation and the desired goals enables the individuals to perform actions towards achieving of the goals. Activity model consist of three stages: the orientational stage, the executive stage, and the evaluative stage (Bedny & Meister, 1999). During the first stage the internal representation of the world is developed. In the second stage the actions needed to achieve the desired goals are performed. In the last stage the situation is evaluated, outcomes of this evaluation are feedbacked to the first two stages. This model is illustrated in Figure 3.3. Each block
Smith and Hancock (1995) describe SA as: 'externally, directed consciousness' that is an 'invariant component in an adaptive cycle of knowledge, action and information'. Smith and Hancock (1995) argue that the process of achieving and maintaining SA revolves around internally held mental models, which contain information regarding certain situations. These mental models facilitate the anticipation of situational events, directing an individual's attention to cues in the environment and directing their eventual course of action. An individual then conducts checks to confirm that the evolving situation conforms to their expectations. Any unexpected events serve to prompt further search and explanation, which in turn modifies the operator's existing model. The perceptual cycle model of SA is presented in figure 3.

Unlike the three level model (and similar to the activity theory model), which depicts SA as a product separate from the processes used to achieve it, SA is viewed as both process and product, offering an explanation of the cognitive activity involved in achieving SA and also a judgement as to what the product of SA comprises. Smith and Hancock’s (1995) complete model therefore views SA as more of a holistic process that influences the generation of situational representations. For example, in reference to air traffic controllers ‘losing the picture’, Smith and Hancock suggest that ‘SA is not the controller’s picture. Rather it is the controller’s SA that builds the picture and that enables them to...

Figure 3.4: Perceptual cycle model of situational awareness (adopted from (Smith & Hannock, 1995))

has its own role in the development of the SA and its maintenance. P. M. Salmon et al. (2008) briefly explain the working principle of this model. External information receives the internal interpretation and meaning (block 1), which are influenced by the desired goals of the individual (block 2), conceptual model of the current situation (block 8), and past experience (block 7). The internal interpretation of the newly analyzed information can change the goals (block 2), past experience (block 7) and the understanding of the current situation (block 8). Individuals identify critical features of the world (block 3) based on the significance of and motivation towards the task goal (block 4) and engagement with the world (block 5). The individual’s goals (block 2) and the evaluation of the current situation (block 6) determine the extent to which individuals engage the task goals. Experience obtained from the interaction with the world is stored in the experience (block 7) and adjusts the individuals representation of the world (block 8). Bedny and Meister (1999) argue that SA is produced by the combination of the following key processes: conceptual model (block 8), the image-goal (block 2), and subjective relevant task conditions (block 3).

Stanton et al. (2001) points out that this model looks incomplete: block 4 and block 5 are not directly influenced by the block 2. Despite this, this theory does describe the situational awareness.

Smith and Hannock (1995) present the alternative view on the situational awareness, which is based on the model proposed by Neisser (1976) (Stanton et al., 2001). According to them the Situational Awareness is based on the individual’s interaction with the world. Figure 3.4 illustrates this model: the actual environment is sampled, the gained information is served to update the internal representation of the world, which directs the eventual course of actions.
3.2 Shared situation awareness

Endsley (1989) and Endsley and Jones (2001) make the distinction between team SA and shared SA. Shared SA refers to the level of overlap in common SA elements between team members. That is, each team member has specific SA requirements for their task, some of which may overlap with other team member’s requirements. Shared SA is defined as: ‘the degree to which team members have the same SA on shared SA requirements’ (Endsley and Jones 1997, p. 54). Team SA, on the other hand, is defined as: ‘the degree to which every team member possesses the situation awareness required for his or her responsibilities’ (Endsley 1995, p. 31). Endsley (1989) suggests that, during team activities, SA can overlap between team members, in that individuals need to perceive, comprehend and project SA elements that are specifically related to their specific role in the team, but also elements that are required by themselves and by members of the team. Successful team performance therefore requires that individual team members have good SA on their specific elements and also the same SA for those elements that are shared (Endsley and Robertson 2000). This is represented in figure 5.

In conclusion to a review of team SA in aircraft maintenance teams, Endsley and Robertson (2000) suggested that good team SA is dependent on team members understanding the meaning of the information that is passed between one another. According to Endsley and Robertson (2000), this means that teams need to share pertinent data and the higher levels of SA, such as the significance of SA elements to the team’s goals and also projected states. Endsley and Robertson (2000) go on to suggest that the primary factors linked to team performance are shared goals.

P. M. Salmon et al. (2008) evaluate several SA models including three theories described above. Three level model (M. R. Endsley, March 1995) is the most cited and widely applied. Its success is based on the intuitive description of SA and therefore simplicity of its understanding. The three levels of the hierarchy simplify the implementation of the trainings which aim to increase SA. The three level model specifies factors which influence the development of the SA. The activity theory (Bedny & Meister, 1999) gives a dynamic description of the SA. P. M. Salmon et al. (2008) point out that compared to Endsley model activity theory is dynamic: the world constantly modifies SA while SA modifies the interaction with the world. According to P. M. Salmon et al. (2008) the perceptual cycle theory (Smith & Hannock, 1995) gives the complete description of how SA is achieved and maintained. It is also based on sound theory (Neisser, 1976). Stanton et al. (2001) state that all three theories have the elements of truth in them.

SA focuses on the individuals and it is not sufficient to analyze the problems occurring in inland transportation. However, it is required to understand the theories presented in the following sections.

3.2 Shared Situational Awareness

Situational Awareness of the individuals is quite a complex topic, however the world is not made up of a set of independent individuals. Organizations consist of departments, divisions, teams and to operate properly all members of the team require to have Shared Situational Awareness (SSA) to a certain extent. The problem starts with defining the concept of SSA. Nofi (2000) distinguishes difference between “awareness of the shared situation” and “shared awareness of a particular situation”. Perla et al. (2000) define SSA of a team as the overlap...
in situational awareness of team members. P. M. Salmon et al. (2008) mention one more definition of SSA: “team SA comprises each team member’s SA and the degree of shared understanding between team members”.

Salas et al. (1995) propose a framework for conceptualization of team SA, which is presented in Figure 3.5. It consists of individual SA (left blocks) and team situation (right blocks). The basic elements of individual SA, knowledge and processing, influence on each other. The elements of teams (team processes and team tasks with team characteristics) interact and affect each other. According to Salas et al. (1995) “the resulting situational awareness can modify all the contributing elements, both directly and indirectly”.

M. R. Endsley and Robertson (2000) cite the definition of team SA given by M. Endsley (1989): “the degree to which every team member possesses the situational awareness required for his or her responsibilities”. The concept of team SA implies that each member of a team needs information for his job. Figure 3.6 represents the requirements for SA of each team member, there are also the areas of overlap, meaning that some requirements only concern the particular team member while other requirements are shared by multiple team members. To successfully operate the teams members need not only to have a good SA for their own requirements, but also the same SA of the shared requirements. Thus, from Figure 3.6 the shared regions have to be understood in the same way by corresponding team members.

In this section the theory concerning the Team Situational Awareness is presented, it can be seen as a second level of SA: first individuals have to be aware of their own situation, and then of the situation within the team. Teams exist in order to reach a common objective. However, the different actors in inland transportation do not share a common objective, they all pursue different goals. Independence of the actors in inland transportation makes Team SA not sufficient for the understanding inland transportation. One more level in SA is required, it is discussed in the next section.
3.3 System Shared Situational Awareness

Authors of theories described in previous Section 3.2 focus on the teams within one organization: airlines, army, etc. However, organizations are not isolated: they have partners, competitors, regulators, etc. In many systems the analysis of individual actors does not provide sufficient information about the system behavior. The system approach is required.

Literature suggests to analyze the system from two perspectives: technical and social (Ropohl, 1999). The technical part of systems consists of used equipment, infrastructure, protocols, contracts, etc. The understanding of technical aspects of the system is the starting point of the system analysis. In each system there are actors, which have interests, habits, cultural influence, personal feelings, etc. This requires a deep knowledge of the social aspects of the system. However, the technical and social aspects of the system are not independent and isolated from each other, they actively interact and influence each other: the high fuel prices (technical aspect) forced the drivers to adjust their behavior (social aspect) in regard to the car usage, this forced the car manufactures to produce more fuel-efficient cars (technical). The socio-technical analysis (Trist, 1981) is required to understand large technical systems comprising multiple stakeholders. As an example the following systems can be named: transportation networks, energy distribution, supply chains. The socio-technical analysis is not only required for the analysis of the system performances, it is needed for the actors to operate more efficiently. The knowledge about the system, its actors, their influences, their power, used equipment, planning aspects, etc., and the ability to adjust their behavior based on this knowledge, is required for each actor in the system for more efficient performances of the individual actors and the whole system. This can be seen as a third level in the Situational Awareness.

Kurapati et al. (2012) present the results of research conducted by IBM among supply chain network managers (IBM, 2010), it shows that 70 % of supply chain managers are concerned about the lack of visibility, transparency and awareness in the networks. Lack of situational awareness can be seen as a root of these problems. The difference between teams of independent organizations and team within one organization is that hierarchy does not exist, and no regulation aiming to achieve higher SSA can be pushed to the members. This requires additional level in theory of situational awareness: system level. However, the literature does not pay a lot of attention to the shared SA in multi-stakeholder networks.

Kurapati et al. (2012) propose the framework for SSA, analogous to the Capability Maturity Model proposed by Humphrey (1988). Framework for SSA distinguish three maturity levels for SSA (Kurapati et al., 2012):

1. **Perception**: The ability to sense the environmental factors needed in the given situation.
2. **Prescription**: The ability to slightly adjust own plans in case when other participants are affected.
3. **Participation**: The ability to perform joint actions and mutual adaptation to the problems that have occurred.

The aim of the framework is to describe the purpose of SSA in socio-technical systems. It defines the objectives for three decomposition levels for three maturity levels. In Table 3.1 these objectives are presented along with the requirements for each objective. This three level framework can be seen as an extension of the models of SA and SSA proposed by M. R. Endsley (March 1995): maturity levels represent three levels of the Dynamic Decision
### Objectives

| Maturity levels | System resolution | | |
|-----------------|-------------------|-------------------|
| Individual      | Team/Group         | System            |
| **Level 3: Participation** | **Flexibility** to adapt and respond to unexpected situations | **Synergy** is a key ingredient for cooperative joint actions in dynamic environment | **Innovation** in processes, operations and technologies is essential for competitive ability. The system needs to be collectively innovative to deal with complex situations |
| **Level 2: Prescription** | **Compliance** to planning is crucial for preventing deviations that could affect others in the system. The gap between what an individual perceives and what he/she does needs to be reduced | **Coordination** is one of the key team processes required to create team SA | **Network governance** to monitor each others’ plans and actions, the system direction and to create a sense of communality and shared destiny |
| **Level 1: Perception** | **Goal orientation** for individual goal setting | **Team goal orientation** for awareness of processes towards shared goal setting | **Positioning** of a high level goal needs to be broad to allow negotiation, as well as to steer the system in a particular direction |

### Requirements

| Maturity levels | System resolution | | |
|-----------------|-------------------|-------------------|
| Individual      | Team/Group         | System            |
| **Level 3: Participation** | **Spatial abilities, attention sharing, memory capacity, perceptual skills, analytic skills, cognitive complexity, field independence, and locus of control, for flexible and effective response** | **Shared vision and values, strengthens cooperative efforts among team members and reduces conflicts** | **Communities of practice-Groups** who regularly engage in sharing and learning can create an environment for better performance and innovation in a growing, complex network. |
| **Level 2: Prescription** | **Feedback** measures such as key performance indicators have proven to improve individual performance as well as contribution to the team and organization. | **Awareness of other’s plans and impact of actions is essential for coordination of team plans** | For network governance **interoperability** is required to coordinate plans among stakeholders, to monitor plans and operations and take corrective decisions if needed |
| **Level 1: Perception** | **Individual goals and self awareness for goal-oriented task analysis to determine requirements for comprehension and integration of information and projection of future state for a situation** | **Team goal and awareness of other’s actions to enable goal coordination, which requires common ground and inter-predictability** | **Joint mission** has to be established to have a platform for negotiations for an acceptable system goal |

Table 3.1: Objectives and requirements for SSA for socio-technical systems (Adapted from (Kurapati et al., 2012)).
Making model represented in Figure 3.2. From the perspective of the resolution the scale has been extended from individual and group awareness (SA and SSA) to a system scale.

Inland transport can be seen as a socio-technological system (De Bruijn & Herder, 2009): multiple actors are involved, the interests of the authors are heterogeneous. Technical aspects include sea vessels, terminal equipment, trucks, barges, regulations, contracts, etc. From the social aspects it should be noticed that the size and power of the companies involved in inland transport are not equally distributed: large shipping lines and container terminals contact with relatively small transport companies. As for all socio-technical systems mutual understanding of each others activities can be beneficial for all actors involved in inland transportation, thus, the System level of SSA is also crucial for inland transport.

The theory presented in this section is used to understand the performances of inland transportation. Further in this chapter the investigation is conducted of how to increase SSA in inland transportation. It starts by presenting hinterland transport as a complex adaptive system.

3.4 Hinterland transport as a complex adaptive system

Hinterland transport as a socio-technical system can be often seen as a complex adaptive system (De Bruijn & Herder, 2009). From the characteristics of such systems summarized by Mitleton-Kelly (2003) the following are valid for container transport:

- connectivity & interdependence: the parties involved in the container transport cannot operate without communicating to each other and the decisions of one influence the others
- co-evolution: the evolution of one party causes the changes in the behavior or structure of other parties: for example, if customs changes their working procedures, all other parties have to adjust their internal and external processes.
- the need for exploration of the environment: the organizations in hinterland transport are always in constant need of finding new clients, partners; they need to constantly monitor the environment for threats and opportunities.
- feedback: the organizations provide feedback to each other concerning each other's performances.
- self-organization: the companies involved can go bankrupt, merge together, change the market of operations, etc, which can be seen as self-organizing of the system and creating new order.

Bekebrede (2010) proposes the framework which can be used to observe and analyze the complex adaptive systems. It consists out of three levels: agent-actor level, network level and system level. Figure 3.7 illustrates three levels of complex adaptive systems in their environment. Further in this section the levels are explained from the perspectives of the container transport.

3.4.1 Environment of container transport

Complex adaptive systems are open systems, which means that the surrounding environment influences these systems, they are not isolated from the environment (Bekebrede, 2010). In
case of hinterland transport of containers this influence is expressed by different factors. Sea-container transport is at the heart of the global economy, this makes hinterland transport dependable on the global economy. The second factor influencing the container transport is domestic and international legislation. The companies must fulfill all the requirements in order to be able to operate. The state of the transport infrastructure, the level of the traffic congestion, the corruption level, cultural aspects, etc. can be named as other environmental factors. Any changes in the environment lead to the adaption of the system of hinterland transport.

### 3.4.2 Agent level

The lowest conceptual level is represented by the agents. Bekebrede (2010) presents the discussion about the agent level. Several agents exist in the scope of the hinterland container transport. The most important agents are: sea-container terminals, shipping lines, inland carriers (rail, barge, trucks), transport organizers, customs. All of them receive the input from output of other agents and process it to own output based on the internal state and rules (Bekebrede, 2010). For example, customs receive a customs declaration from the shipping line concerning certain containers. Based on the available information about this shipping line, the end client, results of risk assessment etc. customs decides what to do with the containers. Their decision (output) is accepted by other agents as input for their actions.

### 3.4.3 Network level

The agents are interconnected with each other based on the contractual agreements, rules from the government, personal relations between the agents, etc. These interactions between the agents can be seen as a network level in complex adaptive systems (Bekebrede, 2010). In hinterland transport the client orders the transportation of the containers based on the
prices, previous experience, the desired delivery times. In their turn the organizers of the transport book the physical transport providers based on the factors which are important for them. The agents involved in physical transport communicate and interact with each other based on the established procedures. The customs have their rules which play role in how they monitor the container flow. For example presence of AEO certificate in all parties in the chain decreases the chance of a customs check. Thus, interrelations between the agents are based on their own state, previous experience, the state of the counter party, etc.

3.4.4 System level

The system level describes the system behavior which is dependent on the individual agents, the interaction between them under the input from the external environment (Bekebrede, 2010). The whole system can be seen as a agent which process the input from the environment and its own output. Bekebrede (2010) names the output of the system as an "attractor", “the area where the system output ‘wants’ to go”. The hinterland transport physically transport the containers from the hinterland to the sea-vessels and back. It experiences the problems which are the subject of this project, and constantly changes.

In this section the hinterland transport is presented as a complex adaptive system. This is a starting point for the investigation of the appropriate methods to increase SSA in the container chain.

3.5 Games

In Section 3.1, 3.2 and 3.3 the situational awareness on different levels is presented, Section 3.3 shows the need for the shared situational awareness in inland transport. From previous section it is clear that inland transportation can be seen as a complex adaptive system. The next question is how to increase SSA in the complex adaptive systems. This section is dedicated to this question.

Kurapati et al. (2012) mention the lack of the literature on the shared situational awareness in independent organizations. Hadzikadic, Carmichael, and Curtin (2010) investigate the relations between the complex adaptive systems and the game theory. The basic property of the game theory is that the performances of actors depend on the decisions and actions of other players (Ahmed, Elgazzar, & Hegazi, 2005). This statement is also valid for the inland transport, where all parties are interrelated. While the game theory is not the same as games, they are highly interrelated (Shubik, 1971). Bilsen et al. (2010) discuss the use of the games for understanding of complex adaptive systems. They show that after playing the game players’ knowledge about the topic of game increases. However, to reach this result the game itself must be a complex adaptive system (Bilsen et al., 2010) and the reality which is represented by the game cannot change (Hadzikadic et al., 2010).

The link between the game levels and the levels of the complex system are illustrated in Figure 3.8. The games are played by the players which play according to certain rules. The actions performed determine the state of the game. Similar to the levels of the complex adaptive systems discussed in Section 3.4 Bekebrede (2010) defines three levels in the games: player level, rule and interaction level, game state level. The player level is described by the role which the players take. According to their role they make decisions and perform
actions. At the same time the possible actions and different kinds of the constrains are
described in the rules and level of interaction. The last level describes the status of the
game at a certain moment. Actions performed by the players together with the rules of the
game result in the game state.

Figure 3.8: Comparison of a complex system with a game world. Both are conceptual represen-
tations, and neither exists apart from each other. Systems as well as games are situated in an
environment and are therefore open systems.(Adopted from (Bekebrede, 2010)).

As the hinterland transport is a complex adaptive system and the game is an appropriate
tool to study such systems, the game is chosen as a tool to increase SSA awareness among
actors involved in hinterland transport. In this section: the game as an educational tool
is explained; the place of the game in the learning process is identified and the reasons for
using the game in this project are explained.

3.5.1 Game in Learning process

In this project the game is used as a main tool to increase SA. In this section the learning
process is analyzed in order to verify the claim that the SSA can be increased by a serious
games.

Bloom’s taxonomy (Krathwohl, 2002) distinguishes different stages in the learning pro-
cess. Original taxonomy distinguishes Knowledge, Comprehension, Application, Analysis,
Synthesis, and Evaluation. Revised version (Krathwohl, 2002) proposes to split this one-
dimensional process into the ”word” and ”the noun”: Knowledge Dimension and Cognitive
Process Dimension. Knowledge dimension consists of four knowledges (Krathwohl, 2002):

- Factual: the basic knowledge about the topic.
- Conceptual: interrelations between the basic elements.
- Procedural: the knowledge about how to do something, the criteria to choose to use
  skills, certain actions, methods, etc.
- Metacognitive: ”Knowledge of cognition in general as well as awareness and knowledge
  of one’s own cognition” Krathwohl (2002).

The Cognitive dimension consists of the following ”verbs”: Remember, Understand,
Apply, Analyze, Evaluate, and Create. The idea is simple: before you can understand
the topic you have to remember facts about it, before you can apply the knowledge you
need to understand it, etc. The highest level is a creation of something new based on the
gained knowledge. In Table 3.2 two dimensions are presented, each learning objective can
Verb
Noun          Remember   Understand  Apply  Analyze  Evaluate  Create
Factual       
Conceptual    Example     
Procedural    
Metacognitive SSA

Table 3.2: Two dimensions in Bloom’s Taxonomy: the learning objectives of an example and SA are mapped.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Objective</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Retention</td>
<td>Lectures, books, notes, video presentation, computer-base instruction, readings</td>
</tr>
<tr>
<td>2</td>
<td>Organizing</td>
<td>Discussion, debates, cases, workshops</td>
</tr>
<tr>
<td>3</td>
<td>Experiencing</td>
<td>Games, roles, labs, simulation, tutoring, on-the-job training</td>
</tr>
<tr>
<td>4</td>
<td>Firming</td>
<td>Test, projects, monitoring, grading, performance evaluation</td>
</tr>
</tbody>
</table>

Table 3.3: General model of learning process (Adopted from (Hsu, 1989)).

be mapped to a certain cell in this table. For example: psychology student must be able to identify different characters during the practicum. An appropriate verb is Understand knowledge which he first acquired to identify the difference. The type of knowledge he has to Understand is Conceptual: the interrelations between the basic elements. This example can be mapped to the cell Understand/Conceptual.

Shared Situational Awareness among the actors involved in hinterland transportation is less easy to map into the table. Coming back to the model presented for the individual SA by M. R. Endsley (March 1995), which is illustrated in Figure 3.2, the elements included in SA are Perception, Comprehension and Prediction. Thus, the actor needs to be able to collect information (Remember new information), to categorize it, to recognize the patterns (Understand gathered information), to make a prediction about the future (Apply knowledge to the future). Action execution is not a part of the SA, thus the “verb” Create (execute action based on knowledge) is not essential. Decision (Analyze and Evaluate) is also not the part of SA, the different factors are evaluated during the decision making, alternatives are weighed based on the available information. Thus, the “verb” for increasing SA is Analyze. The knowledge which should be increased is Metacognitive. The first three “knowledges” are not sufficient for SA. Hence, the SA can be mapped in the Table 3.2 to the cell Analyze/Metacognitive.

Bloom’s taxonomy helps to categorize and analyze the learning objective. However, it does not provide the methods in order to reach these objectives and it is also complex. Hsu (1989) proposes simpler model which consists of four phases: retention of information, organizing the knowledge, experiencing procedural knowledge, and firming through evaluative feedback. He identifies appropriate methods for each phase. In Table 3.3 the phases and the appropriate tools for each phase are presented.

Compared to Revised Bloom’s taxonomy the Hsu model combines the verbs Analyze and Evaluate together and leaves the Create outside the learning process. In phase 3 the students apply the knowledge, which they gained in phase 1 and 2, in environment that is
monitored and controlled by the teacher. After that they are evaluated based on the tests and projects. Most of the universities follow these stages: lectures followed by workshops, which are followed by some practical assignments and final tests.

Each phase requires different tools, various tools are a rather good supplement to the whole learning process. Hsu (1989) also applies this learning process model to the management education and argues that different managerial skills (Mintzberg, 1980) need different approaches. It does not differ significantly from the original model, however an adjusted model mentions that learning professional skills such as Leadership, Conflict Resolution Skills, etc. are done in the third phase.

The Shared Situational Awareness can be seen as one of the managerial skills, which is needed as an input for the successful decision making, as illustrated in Figure 3.2. However, SSA is a vague concept which needs shared understanding of the particular situation. The word “shared” makes two first stages less important in the learning process due to its static nature. This makes phase three most important. At the same time this research focuses on the actors involved in the land-side transport of the containers from/to the port of Rotterdam, meaning that the target group already has significant amount of knowledge concerning the activities around the containers. Thus, first two phases of the learning process cannot significantly increase Shared SA and the main focus should be on developing a tool for phase 3. It should be noted that the other stages must still be present in order to supplement the tool(s) used for phase 3. For example, in a case when one of the players does not have particular knowledge about a particular aspect implemented in the game, it is necessary to provide him with this knowledge (phase 1).

In Table 3.3 games are identified as one of the tools for gaining practical experience. Their use is well established in the management (Holweg & Bicheno, 2002). Duke and Geurts (2004) lists multiple objectives of the policy games:

- Improving communication: gaming supports the communication.
- Need for consensus: game has an ability to explore the conflict if such exist and to reach the consensus.
- Commitment to action: game can show the players the positive aspects of new policies, show the drawbacks of existing situation and ways to solve the problems.
- Stimulating creativity: Game provides safe environment for the players, where the participants are not afraid to make mistakes by trying new unexplored approaches.
- Understanding the complexity: an objective of many games is to provide the players with knowledge about a holistic view of the complex systems.

These objectives can be linked to the desired objective of increasing SSA in hinterland transport. The next question is what a game is and how something, that most people associate with kids, can have a positive influence on something as serious as transportation. Next sections are dedicated to answering these questions. First the history of the serious games is presented, then the games are discussed.

3.5.2 History of games

The army as one of the key innovators in the past has noticed the advantages of gaming for the military purposes and started implementing war-games a long time ago. These games
evolved from board games of Wei-Hai originating in about 3000BC and the Hindu game of Chaturanga (Wolfe, 1993). The Wei-Hei used the ideas of Sun-Tzu and the main objective of the game was to outflank the opponent, and Chaturanga went even further and increased the visualization by introducing the figures and random events simulated by a dice. Probably the famous chess game is just an evolved version of Wei-Hai: it simulates a battle with different kinds of figures representing real troops of that time: pikemen, knights, etc. In 17th-18th centuries the war games became more complex, aiming to simulate war environment as precisely as possible. The culmination of this development was New Kriegspiel introduced in 1798, a very complex and complicated game, where just the rules took 60 pages to describe, actual maps were used, and the enormous variety of actions were offered to the players (Cohen & Rhenman, 1961). The military games became more popular among military specialists and were introduced in the armies of different countries. Japan even used the war game as one of the crucial analyzing tools for entering the WWII (Cohen & Rhenman, 1961). But the question that arises is why such a serious business as army uses games. The answer is quite obvious: games give the opportunity to simulate versatility of complex problems of tactics and strategy (Weiner, 1959), the tactics can be tried through different roles and one can look at the situation from another point of view.

After the WWII the game theory has attracted the attention of the business world. War and business have many common characteristics: both have rivals with whom the constant competition is going on, both have constrains such as budget, time, etc. Managers play themselves during these games. They have to make decisions based on limited information in a limited time. As an example of the first game of such kind, Top Management Decision Simulation can be named (Faria, 1998). Since then many games have been developed, differing in the number of decision making alternatives, rules of the games, number of players and the complexity of the problem. These games have been used as a part of executive training programs and educational courses. The rate of diffusion of the business games has increased, Table 3.4 shows the findings of Farias research on the usage of simulation games at the Association to Advance Collegiate Schools of Business (AACSB, 2012).

<table>
<thead>
<tr>
<th>Year of the research</th>
<th>Percentage of using simulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1962</td>
<td>71.1%</td>
</tr>
<tr>
<td>1969</td>
<td>90.7%</td>
</tr>
<tr>
<td>1975</td>
<td>94.5%</td>
</tr>
<tr>
<td>1987</td>
<td>95.5%</td>
</tr>
<tr>
<td>1998</td>
<td>97.5%</td>
</tr>
</tbody>
</table>

Table 3.4: Usage of simulation games at AACSB Member Schools (Adopted from(Faria, 1998).

Faria (1998) also shows that the rate of usage of simulations in the business environment has also increased from 55.3% in 1987 to 62.2% 1998. Nowadays the games remain popular and are used in many fields: education, healthcare, defense, art and culture, religion, Corporate Training and Advertising (Djaouti, Alvarez, Jessel, & Rampnoux, 2011). The success of a serious games can be explained by the opportunity not only to simulate the results of the decision in the controlled environment but also because these games provide a possibility to try on a different role, to become an opponent in a safe environment. The last means that decisions made during the game do not have any consequences in real-life.

This section presents the history of serious games which started in the army and is currently widely integrated in many fields.
3.5.3 Serious Game

In previous section the history of the game is presented. Next question is what a serious game is? Literature gives a lot of definitions. Bekebrede (2010) dedicates a part of his dissertation to games, in order to understand the consequences of expansion of the Port of Rotterdam. She uses two definitions presented by Juul (2005) and Klabbers (2006):

Games are rule based systems with variable and quantifiable outcomes, in which different outcomes are assigned to different values, the player exerts an effort in order to influence the outcome, the player feels attached to the outcome, and the consequences of the activity are optional and negotiable (Juul, 2005).

A game is a form of play. It is an activity involving one or more players who assume roles while trying to achieve a goal. Rules determine what the players are permitted to do, or define constraints on allowable actions, which impact the available resources and therefore influence the state of the game space. Games deal with well-defined subject matter (content and context) (Klabbers, 2006).

The main educational effect of games is based on "learning by doing" (Haapasalo & Hyvönen, 2001), people can gain knowledge about the topic by doing it. The game, which imitates and simplifies reality (Forssén-Nyberg & Hakamäki, 1998), provides a possibility for experiencing real life: decision-making under uncertainty and time pressure with insufficient or sometimes faulty information (Baird, 1981).

The advantage of the games over other educational methods is mentioned in the first definition: "the player feels attached to the outcome". Students are motivated to play and win the game (Raia, 1966), they are involved with the theme of the game (Baird, 1981). In case when the game results are linked to the learning objectives, the players are encouraged to study the topic of the game and the learning effect increases significantly (Baird, 1981). However, the game must be properly designed in order to increase motivation for play. Kiili (2005) explains that the learning effect is at highest when players enter the Flow experience, which is originally proposed by Csikszentmihalyi (1975). Being in the Flow means complete dedication to the activity (Csikszentmihalyi, 1990). In order to reach this effect the game should not be too difficult or too easy for the player. The knowledge of the player about the topic as well as his skills must be taken into account during game design. Figure 3.9 presents the balance between a boring and a difficult game. Kiili (2005) points out that a

![Figure 3.9: Game balance between skills and challenge. (Adopted from (Csikszentmihalyi, 1975)).](image-url)
game should be usable and have clearly defined goals, the players must receive feedback during/after the game in order to increase the flow experience.

To attract players, games have a story attached to it. Games consist of different parts, different actors, play maps, etc. and a story, which integrates all game elements (Rollings & Adams, 2003). Based on the complexity of the game, a story can be very simple: a short description of the game before the beginning, or a complex one with intermediate feedback and a changing story based on the performances of the players. On the other hand, a story can distract players from the original learning objective. Another aspect in the game design which must be noted is whether to make game competitive or not. The competition increases the realness of the game, also the players experience more motivation to play a game due to rivalry. It also distracts the player from the main learning objectives (Baird, 1981). Thus, it is up to the designer of the game to find the balance between the attractiveness of the game and the educational effect (Kiili, 2005).

Games can be used as a simulation tool for analyzing the current situation and evaluating new ideas (Savolainen, 1997). Garris, Ahlers, and Driskell (2002) name the reality as one of the characteristics of a simulation games. Literature poses a requirement that a game must be ended with a de-briefing round (Forssén-Nyberg & Hakamäki, 1998; Kriz, 2003; Duke & Geurts, 2004; van der Meij, Leemkuil, & Li, 2013). De-briefing refers to “a common consolidation of an experience in view of an evaluation of the psychic and social processes (cognition, emotion, communication, negotiation, etc.) that took place during the game”. During the de-briefing the knowledge gained during the game can be translated to the real-life situations. Also the players can express their emotions and provide feedback (Duke & Geurts, 2004).

The objective of this project is to design a game, the key element in the game session, to increase the Shared Situational Awareness in inland transport. The pitfall of this objective is that SSA is not simple and it is not possible to just learn it, it does not consist of well-defined elements. However, it is possible to make players aware of the importance of SSA. It requires the problems of the reality, which can be solved (or at least understood) by the higher levels of SSA, to be pointed out. The simulation game can be used to simulate the problems of hinterland transport. The game performances must depend on the degree of mutual understanding of each other’s problems. An additional aspect to be taken into account during game design is the game costs. Along with the costs of the game development and game running, there are opportunistic costs (Cohen & Rhenman, 1961): the players are from the industry, they cannot spent days playing the game.

This section validates the assumption of using the game as a key element to increase SSA. The place of the game in the learning process is identified. This is followed by explaining the learning effect of the game. The theory presented in this section is used as an aid for designing the game. The last thing left for the discussion is how to measure the learning effect of the game.

### 3.6 Measuring Shared Situational Awareness

The purpose of the game session is to increase the Shared Situational Awareness in container transport. To evaluate the outcomes of the game session, one needs to measure the SSA of the players before and after the game session. No universal approach to measure SA or
SSA exists (P. M. Salmon et al., 2007). P. Salmon, Stanton, Walker, and Green (2006) list different methods to measure SA, which can be categorized into direct (objective probes techniques, subjective questionnaire) and indirect, methods which translate the physiological state, performances, behavior to level of SA (Saner, Bolstad, Gonzalez, & Cuevas, 2009). The examples of the measuring techniques are (P. Salmon et al., 2006):

- Real-time/freeze probe techniques: often used techniques which imply taking the probe of actors’ knowledge about the situation by asking a set of questions during the execution of the assignment (real-time) or when the assignment is paused.
- Self-rating techniques: the set of questions is asked, and the subject of the analysis has to answer them.
- Observer-rating techniques: an expert in the field observes the players behavior and makes a conclusions about the SA level.
- Performance measures: during the task execution certain performances are registered and used to indirectly determine the level of SA.
- Process Indices: observe the action/process which leads to increase of SA.

These methods focus on measuring the SA. Although there has been little research on the measuring techniques for SSA, the similar techniques can be used in an adjusted form in the context of the SSA (P. M. Salmon et al., 2007). Each method has its own advantages and disadvantages. However, it is more important to choose not the best method to evaluate the SSA, but the most appropriate one for a particular case. Within the working group it is decided to use the combination of three techniques: observer-rating, performance measures and self-rating.

**Observer-rating.** The game session simulates the real world. Game master can be used as an expert who observes the performances of the players. However, there is a gap between the reality and the game world, hence, the link between the behavior during the game and in reality is not strong. Also one cannot assume that the game master is a professional in the field of the SSA in hinterland transport. These two factors make the observe-rating technique not sufficient as the only method.

**Performance measures.** The performances of players’ activities such as money, speed, collected bonuses etc. can be used for evaluating SA as performance measuring technique suggests. The results from two rounds are compared with each other, it is assumed that in the first round has no SSA, and the enhanced performances of the second round, if any occur, are caused by the increased SSA.

**Self-rating.** These two techniques indirectly infer the SSA. The participants of the game are the experts in the field of container transportation themselves. Their knowledge about the field can be used to evaluate the level of SSA. This can be done during the evaluation phase of the game session. Thus, the first two methods are backed up by the method of self-rating techniques.

The methods of evaluating SSA are the last topic relevant for this research. The observer-rating, performance measures and self-rating methods are used to evaluate effect of the game on SSA of the players.
3.7 Sub-conclusion

This chapter presents the theoretical foundation for this project. First the Shared Situational Awareness in distributed systems is derived from the Situational Awareness and Team Situational Awareness. After that the inland transport is presented as a complex adaptive system. It is demonstrated that the inland transport as a complex adaptive system can be learned by the means of a game. However, Shared Situational Awareness is not just knowledge about the system, the game is capable of simulation different situations and pointing out the positive effect of the SSA. The effect of the game can be maximized when used as a part of the game session consisting of lecture, discussion, game and evaluation.

The last aspect discussed in this chapter is a means to measure the learning objective. Literature proposes different methods to measure SSA. In this game the SSA is measured by three different techniques: observer-rating method, performance measures and self-rating. The first method implies that the game master observes the game processes. The performances of the players expressed by the money they have are used for the second method. The self-rating methods imply the evaluation of players own SSA by sharing their experience with the game.

The game and the game session are designed based on the theory laid out in this chapter. Before presenting the game design process, the next chapter provides a detailed study of the inland transport.
In Chapter 1 the overview of the sea-transport is presented. This project focuses on the aspects of the inland transportation of the sea containers to/from the container terminal. This chapter starts with a detailed discussion of the actors involved in container transport, the most crucial actors are identified. Further these parties are examined in more detail to understand the working principles and to derive a list of problems caused by a lack of the SSA. At the end the link between problems and a lack of SSA is presented. The work described in this chapter concerns the first and the second phases of the flow SSA project in Hinterland Transport as presented in Figure 4.1.

4.1 Overview of Actors

OECD (2005) defines five groups involved in container transport:

1. Customer group: senders and receivers of the container;

2. Organizing group: organizing, monitoring, controlling physical transport and documents flow;

3. Physical group: group performing physical processes such as loading/unloading of the vessel, transporting from A to B, etc.;

4. Authorizing group: governmental officials whose tasks involve monitoring compliance of the existing regulations;

Figure 4.1: Research Steps: Inland Transportation.
<table>
<thead>
<tr>
<th>Group</th>
<th>Representatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers</td>
<td>Shippers/Exporters, Consignee/importers</td>
</tr>
<tr>
<td>Organizing group</td>
<td>Freight forwarder/consolidator/NVOCC, Shipping line agent, Customs broker, Buying agent</td>
</tr>
<tr>
<td>Physical transport</td>
<td>Road carriers, Rail operators, Barge operators, Container terminals (sea and inland), Port Services (Pilots, Moors, Tugs), Shipping lines, Empty container Depot</td>
</tr>
<tr>
<td>Authorizing group</td>
<td>Port Authorities, Customs, Chamber of Commerce, Central Bureau of Statistics, Licensing Authority, Consulate, National Health Authority</td>
</tr>
<tr>
<td>Financial group</td>
<td>Banks, Insurance companies</td>
</tr>
</tbody>
</table>

Table 4.1: Actors involved in sea container transportation (Sourced: (Osterhout et al., 2000; OECD, 2005)).

5. Financial group: financial support, facilitating payments, insurances, etc.

In Table 4.1 the main representatives of each group are listed. The transportation is started with the negotiation between the exporter/seller/shipper and importer/buyer/consignee. In case the buyer of the goods is not familiar with the overseas market, he can hire the buying agent who handles buying procedure, arranges required documentations, etc. As already mentioned in Chapter 1 the customer group does not have the required knowledge about the transportation in general and inland transport in particular. This is compensated by hiring organizers of the transportation. Due to the detachment of the customer group from the physical transportation, they are excluded from further discussion in this thesis.

Organizers negotiate transportation rates with the carriers, prepare all the documentation regarding the transport, arrange the dispatch of the empty container to the shipper (or the stuffing center). OECD (2005) mentions that many forwarders provide additional services to the clients such as warehousing, routing, supply chain management, etc. In case if the cargo is smaller than the size of the container, load consolidator can be introduced, whose responsibility is to combine several smaller loads into one container. Several forwarders book the capacity of the ships from the shipping lines in advance and act as a virtual shipping line. In North America such forwarders are referred to as Non-Vessel Operating Common Carriers (NVOCCs) and have larger scope of obligations (OECD, 2005; Rigtering, 2009). Many forwarders are relatively small companies, which lowers their power in negotiations about the transportation rates with the carriers. In such cases some forwarders make use of a Fourth party logistic providers, who book large capacities with the carriers and sell it to smaller forwarders. Customs brokers are agents who have expertise in the governmental involvement in containerized trade. Many forwarders provide this as an additional service. Due to their involvement in the organization of the physical inland transportation on one hand, and their having all the information about the containers on the other hand, the organizers have been studied in more detail during this project.

The physical movement of the containers starts with the shipper. The container is picked up by a truck and delivered to an inland train or barge terminals, alternatively it is directly transported to the container terminal. Barges and trains transport the container to the terminal. At the terminal the inland transport is unloaded and containers are stored in stacks until the sea-vessel’s arrival. Then it is loaded to the ship and transported overseas. The import container undergoes the same steps in the physical transport but in reverse
Despite quite a large number of the container terminals, the main container traffic goes through the largest ports (OECD, 2005; The Journal of Commerce, 2012). The size of sea vessels is constantly growing (The Cornell Group, 2007) resulting in larger container terminals (Kemme, 2012). Along with large container terminals, smaller terminals still exist in ports that are often used by shipping lines operating in short-sea or as depots (Port of Rotterdam Authority, 2013). The situation is similar with the sea careers: the share of several TOP operators is larger than of the rest of operators (the size of TOP 20 fleet is 61% (OECD, 2005)).

Many parties are present in authorizing group, however the most important party in the cross-border transport is customs. The core responsibilities of European Customs are (Douane, 2013):

- to ‘stop’ goods at the border. Some goods are not allowed to enter the country (weapons, drugs, counterfeit goods, etc.). Customs takes measures to prevent these goods from entering the country. It also ‘stops’ the goods which are not permitted to be exported.

- to ‘control’ the proper application of laws and regulations. Goods which are allowed to enter/exit the country are often subject to formalities and obligations, customs controls the execution of those.

- to ‘levy and collect’ taxes. Goods entering or exiting the country are often subject to taxation, customs is responsible for collecting these taxes.

The role of the customs for the container transport can be simplified to two aspects: the import container cannot leave the terminal until the customs releases it, and many terminals do not permit the export container entering the terminal until the customs documents are in order.

The last group are the banks and the insurance companies. They have various tasks, such as facilitating payments, providing insurances, loaning money, etc.

In this section the actors involved in transportation are discussed. Further this chapter discusses physical transportation and layers of transport organizers for inland transportation in more detail as they are directly involved in container transport. The rail operators (RO) are often large companies with a big governmental presence (OECD, 2005); they are only few of them. This makes their bargaining power substantial so that the container terminal cannot exclude them from the decision making process. Also no problems associated with entering the container terminal (such as waiting lines for trucks and berth time for the barges) are experienced by RO. At the same time the share of the containers transported by rail is small, only 10.7% (Port of Rotterdam Authority, 2012b), while the rest of the containers is transported by barges or trucks. Hence, the focus of this thesis is on container terminals, barge operators, truckers and the organizers of the transportation (shipping line agents and forwarders).

4.2 Data Collection

Previous section identified actors directly involved in inland transport profiting from Shared Situational Awareness. Each of them is studied more closely further in this chapter. This section explains which data is to be gathered and a means to do it.
The topics within the scope of this project are: everyday operations and problems caused by the lack of SSA. In the next sections the answers to these questions derived from both literature review and interviews are presented. The representatives of barge operator, trucker, forwarder, and a shipping line agent are interviewed in the course of the project. The description of their procedures and problems is mainly based on the data gathered from the interviews. As no contacts are established with the container terminals, the presented data on the container terminal is only based on the literature review and to some extent derived from other interviews.

The interviews are semi-structured, during each interview the following topics are discussed: the background of the interviewee, the company business, the place of the interviewee in the company, procedures for performing the core business, the relations and problems with the partners, questions about procedures and problems of other actors. When the topic is proposed for the discussion two-way dialog is held within the scope of this topic, when all interesting aspects are discussed, the next topic is proposed. In case if afterwards some information is still lacking after the interview, the topic is discussed over email.

As described in Section 2.3.2 the iterative method is used to analyze the data from the interviews. According to this method the interview transcripts are analyzed as follows: 1) read transcript, 2) read it again, 3) inductively derive a list with all the interesting points mentioned during the interview, 4) pick one point, 5) read the text and mark the text corresponding to this point, 6) read the marked text and make a preliminary conclusion, 7) read the whole transcript again and modify the conclusion, 8) do the last step till it feels right, 9) pick another point and start with 5). The transcripts of the interviews can be found in Appendix D.

In the following sections the procedures and problems of barge and truck operators, transport organizers and container terminals are presented.

4.3 Barge operators

**General Description.** About 39% of the containers are transported by barges at the port of Rotterdam (Port of Rotterdam Authority, 2011b). The goal is to increase the share of the barges in inland transportation up to 45% by the year 2035 (Port of Rotterdam Authority, 2011b). However, the lack of Shared Situational Awareness can act as an obstacle in achieving this goal.

The barge operators provide different kinds of services to the clients such as last-mile transportation, three-modal transportation, forwarding, documentation, etc. However, the main task is the physical transportation of the containers. Three main destinations from port of Rotterdam can be identified: Rhine, Antwerp and The Netherlands. One of the key problems of the barges is the planning of the visit to the container terminal. For barge operators serving the Rhine area this causes substantial problems due to the longer travel time of the barge compared to the planning horizon of the terminals in the port area. Interviews with the representatives of the planning departments of two companies operating barges are performed for this project in order to identify the problems experienced by barge operators on a daily basis.

The interviews are performed in the following companies:

- Danser Container Line ("Danser", "2013") is a part of Danser Group. Danser Container Line focuses on the transport of the containers between Rotterdam/Antwerp
and the Lower Rhine Area. The main destinations in inland are Mannheim, Strasbourg and Basel. The fleet consists of 10 private inland ships. Danser also works with charter-ships. Having different clients Danser Container Lines mainly conducts business with two types of clients: shipping lines and forwarders. The former has a larger share compared to the later.

- Dubbelman Container Transport (DCT, 2013) is a part of Dubbelman Group. The Dubbelman Container Transport focuses on the whole Rhine up to Basel/Birsfelden. On average Dubbelman visits more terminals compared to the Danser, this results in longer round trips of a single barge. The fleet consists of five barges. The main client is the shipping line. The forwarders also make use of their services.

Dubbelman Container Transport and Danser Container Line differ from each other in several aspects: the size of the fleet, the number of inland terminals of calls, etc. However, the interview showed that both operators experience the same kinds of problems during planning of their visits to the Port of Rotterdam. Further in this section the transport aspects of the container by barges are presented. The identified problems are discussed from the perspective of the Shared Situational Awareness.

**Operations.** Andel (2007) presents the barge visit to the PoR from the perspective of the container terminal. It shows how the barge visit is planned and which parties are present. In this section, the focus is shifted to the barge operators. The barges constantly ship from sea-terminals to inland terminals and back according to a fixed schedule.

The clients contact barge operators to book transport. For full import containers, the booking is made 1-3 weeks in advance before the transportation, the transport for empty containers from Rotterdam is performed continuously until one day before the transportation. The booking of export containers is a ”last-minute market”. BO checks the planning and the capacity of the ships and responds accordingly. If there is a match between the wishes of the client and the BO, the booking is confirmed. Along with booking the clients send some of the required information (weight, container number, inland terminal, sea-terminal, etc.), the rest of the information, which is not provided during the booking, is provided later (customs document, PIN codes).

The export containers are loaded on barge and the barge heads to the sea-port. 24-48 hours before the estimated time of arrival (ETA) to the terminal, barge operator registers the visit at Port Infolink. Together with the registration, the desired time of the visit to each terminal is mentioned. 24 hours before the ETA BO receives the confirmation of when the terminal expects the barge. 10-24 hours before the visit barge operators send their discharge and load lists to the terminals. Discharge list declares the containers which the barge is carrying to this terminal. The load list contains information about the containers which the barge is booked to transport from the container terminal. In general both lists are controlled by the terminal. The following things have to be fixed before (un-)loading the containers from/to the barge: container must be registered at the container terminal, pin code for the import containers must be known and customs documents have to be present. If damage to the container is registered during transportation, the client is informed about it.

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1The times here and further are given as an indication, they can differ
Problems. The barges have limited time at the PoR. However, in this time they visit multiple terminals (Danser 7-10 terminals, Dubbelman - 16 Rotterdam + 10 Antwerp). The desired time of arrival of the barge to the terminals at the port during the visit to Rotterdam is based on the geographical location of the terminals. However, container terminals are not keen to adjust their planning to the desires of the BO, and fit the barges into the free slots in their planning. This is mainly caused by the fact that barge operators are not the clients of the container terminals. This problem occurs more often with the size of the container terminal. Van Andel (2007) points out that to visit all the planned terminals, barge operators sometimes lie about the estimated time of arrival. However, the performed interviews showed that this is not possible: if the barge misses its slot, it is not served by the container terminal. Instead, the berth planners and the ship captains negotiate the berth time with each other via phone. Normally the time suiting both BO and CT can be found. In some extreme cases the time cannot be found: on the week of the interview with Danser, the barge could not be unloaded at ECT Delta terminal because the desired berth time differed from the provided time by more than 24 hours. This barge had also containers on board for the terminals in Antwerp. The decision of the planners was to leave the containers on board of the barge. Alternatively, the barge could wait for the time provided by the ECT Delta, however, other export container would miss the sea-vessels in Antwerp. Also the import container would be delivered with a delay to the inland destinations. In such case the terminal and the client are informed about the decision.

The second problem which BO experiences is the rush orders for import containers. Large terminals do not allow adjusting the loading list after some point in time. Both interviewees pointed out that this problem concerns only large terminals. Smaller terminals can be easily contacted by phone, and if the container is ready for the transportation, it can be loaded. BO does not experience this problem with export containers: inland container terminals are relatively small and can serve rush orders, the time between loading the container on board and estimated time of arrival is in general longer than 24 hours.

The next problem for BO is the discharge and load lists:

- Discharge list for the export container: the container is not known by the container terminal. It means that the registration of the container at the terminal is not performed.

- Pin code for import containers. This code identifies the authority of the transport operator to pick up a particular container. If this code is not known, the container cannot be picked up. However, the clients of BO do not always provide BO with the PIN code on time.

- Customs documents. For both export and import containers the customs documents have to be in order. Import containers have to be released by the customs before they can be loaded onto the barge. However, if the client makes mistakes during the declaration of goods or the goods have suspicious origins, the containers are not allowed to leave the port. Even if the customs releases the goods, clients happen to forget to provide needed documents to the BO. In which case, the container cannot be loaded onto the barge.

In all these cases the barge operator requests the client to fix it. If the documents are fixed before the arrival of the barge, the containers can be (un-)loaded.

Some terminals have invested in the IT services for the registration of the visits. IT solutions provide a possibility to the interested parties to check the status of the containers.
at the terminal. The main advantage is that it can be integrated with systems of the partners, so that they can automatically check the status of the containers. Some of the terminals which use these systems, have stopped checking the status of the containers for barge operators. If the transport operator (or any other interested party) does not possess such an integrated system, there is a web tool available for the control of the status of the containers. The use of web-based tools is inconvenient, because the barge operator has to constantly check the status of containers that are not as yet available. The terminal does not load the containers that miss documents.

4.4 Truckers

General Description. Trucks remain one of the most significant inland transportation modes. It is on average more expensive to transport the container by truck than by barges or trains. However, the assumption is that rail- and waterways exist near the destination point. If not, trucks remain competitive, especially in low-range transportation. They are also more flexible and faster. In this section the procedures of the truck operators concerning inland transportation of the sea containers are described.

To discover problems encountered by the companies operating in this industry, an interview was performed with one of the managing directors of International Transport Overbeek, further Overbeek. Overbeek focuses on Benelux, part of Germany and France. A low-range of activities is caused by the increasing competition from barges and trains on longer distances. Another main activity is the inter-terminals transportation at the Port of Rotterdam. They operate from both ports: Antwerp and Rotterdam. The company’s fleet consists of about 30 trucks, differing in size and the special equipment. The largest client of Overbeek is a shipping line. Other clients are several expediters and barge operators. Further in this section the procedures for transportation by truck from and to Port of Rotterdam are presented, followed by the problems encountered by Overbeek on an everyday basis are presented.

Operations. The client contacts the trucking company by phone/e-mail requesting transportation from point A to point B on a certain day, where in the case of Overbeek, one of the points is a terminal at the Port of Rotterdam. If there is a place in planning and an agreement is reached on the financial aspects, the transport order is sent to the trucking company, mostly by email. At least one day before transportation, all the details are provided for the trucking company. The arrival of the trucks to the container terminals is pre-registered. In pre-registration the following aspects about the concerning container are sent to the container terminal: booking numbers, shipping line, type of the container, content and documentation. Import orders are pre-registered in the afternoon before planned transportation, the export orders are registered at the moment the containers are loaded on the truck. Planners can see what the status of the pre-registered containers is, if some information is missing or not complete customs documents, release from the shipping line, etc.), it shows in the system. If not, import containers cannot be picked up and the export containers cannot be delivered to the CT. At the same time the customs documentation has to be present and be in order. All this information can be seen in the computer system of the planners. Port of Rotterdam does not require booking time for the terminal visit. The transport company checks the time of arrival of sea-vessels to know when the delivery/pickup is possible.
Problems. The clients of trucking companies book the transport at a short notice. Only 20% of the orders are received 3 days before the transport day, 60% 2 days, and the rest is received only one day prior to transportation. This short horizon limits planning operations. The next inconvenience which the truckers experience is that the empty export containers lack information about the container depot where they have to be picked up during booking. This information is added to the transportation order one day before transportation, otherwise the truckers have to call the client. The containers are not always known at the container terminal, meaning that the client has not registered the containers properly at the container terminal. In such case CT does not accept the containers. As in the case of barges, the import containers have to be released both by shipping line and the Customs. The client is contacted by the truckers and requested to fix it.

In Rotterdam the arrival time to the terminal does not have to be registered. It results sometimes in long waiting times at the entrance of the container terminals. Overbeek truckers spent on average an hour waiting during the visit to the terminals in the port. 2-3 hours waiting times occur also on a regular basis. There are two reasons for having long lines:

- Large number of incoming trucks.
- The resources of the terminal are directed at serving the arrived sea-vessel.

Some extreme delays are caused by bad weather. For example if it snows, the terminals are (partially) shut down to straw. The clients of the truckers understand the delays is such cases on the day when it snows, however next day they expect the truckers to operate without any delays, which is not possible due to the accumulated work load at the container terminal.

The truck operators try to have everything done before the arrival to the terminal. The documents are checked at the gate of the terminal. Some terminals, for example APM terminals, have a policy that if something is wrong with documents, the truck has to leave the line and when it is fixed, the trucker has to wait in the line again. The trucking companies used to have a problem when the export document was not present during the pickup. The physical document had to be delivered to the CT. In case when the trucking company was responsible for this, the document had to be brought to the trucker standing in the line at the container terminal or the trucker had to wait in the line until the document was fixed. At Overbeek this is resolved by using electronic documentation. The customs declaration can be submitted during transport, and sent over to the trucking company, which submits it electronically to container terminals.

As in the case with barges, the PIN code for import containers is not always provided after the transportation order. It also happens that the truck is already at the terminal, but the container is not yet released by the container terminal. Overbeek experiences this problem with terminals where there is no pre-registration or in the cases when the container must be transported by train or barge but the client has changed the next transportation mode to trucks.

Concerning export containers Overbeek sometimes does not pre-register their visit with export containers on time. The trucks are equipped with tracking devices, but the truckers are not always aware that only their position is known. They assume that everything is visible to the planners and the planners see that the truck is loaded. So they do not report that they are loaded, meaning that the planners do not pre-register their visit.
4.5 Transport organizers

General Description. Container transportation involves many aspects, a lot of formalities, many actors. It is not possible for the end client to possess knowledge about all the local parties involved, and he outsources organizing of transport to transport organizers. As it is mentioned above, different parties can be seen as transport organizers: expediters, shipping line agents, forwarders, etc. From the perspective of transport operators there is no structural difference in being booked by the forwarder or the shipping line. However, in general shipping line has more information concerning the transport, which results in less problems for transport operators. For this project, one shipping line and one forwarder are interviewed.

- Delta Shipping Line. Short-sea shipping line, the focus is on the containers to and from Russia. The inland transportation is often organized by the Delta Shipping Line. Mostly it is done by trucks due to short time in the sea and a small size of the orders. Import containers are 90% empty due to imbalances in trade flows of Russia. The main terminal of call in Rotterdam is RST ZZ, the ships also visit Euromax and ECT Delta.

- Karl Gross. Karl Gross is a typical freight forwarder with head quarters in Bremen, Germany. A number of offices are located around the world, one of them is in Rotterdam. The company offices work independently from each other, however there is still cooperation and support between them. The office in Rotterdam has its own warehouse, where the containers can be loaded and unloaded. They have a license to perform import and export of goods at the warehouse. The primary activity is import of containers, the export of containers happens less often.

A combination of these two companies gives a sufficient understanding of the processes of import and export of containers. The sea-side activities of the Delta Shipping line are left out of the discussion.

Operations. As in previous cases, the client contacts the organizer requesting the possible times, rates, etc. If the booking is confirmed the organizer puts it into the system. The documents are presented to the customs, in case if the client has requested the organizer to perform the declaration. The required documents are uploaded/presented to the terminal. At some terminals, which do not use complex electronic registration systems, the driver must present these documents. For the export container the booking of inland transportation is done one day (sometimes 2-3 days) before the physical transportation. For the import containers, the booking of the inland transport depends on the customs and the shipping line. Both have to release the containers. At the moment customs has no more interest in the container it release it. The shipping line releases the container when it receives the bill of lading. The bill of lading is a document issued by the shipping line to the shipper, shipper hands over the bill of lading to the receiver of the goods, the receiver submits this to the shipping line. The party which has the bill of lading, de facto owns the goods. After the release by both the shipping line and the customs, the organizer starts planning the inland transport. It is possible to start planning earlier, when ship is still at sea, however, this strategy includes uncertainties. The legislation issues are discussed with the carrier during the booking: weight, nature of goods, etc. The documents required to pickup/deliver the containers from/to container terminal are provided to the carrier (PIN codes,
Problems. The following problems are experienced by the organizers:

- **Waiting time at the gate.** The long lines at the gates of terminals lead to higher costs of inland carriers and a possibility of missing vessels.

- **The time-slot at which transportation is performed.** It is common that the containers are (de-)stuffed near the port. The warehouse facilities are open only during the day, so if the container comes to the warehouse at the end of the working day, it cannot be processed there, and (de-)stuffing along with further transport is postponed till the next day.

- **Customs documents.** Without the customs release the containers cannot leave/enter the terminal. The problems occur when due to misunderstanding it is unclear who is responsible for the declaration of the goods. It happens that the customs electronic service breaks down and no declaration can be issued. The emergency procedures exist, however, the customs prefer to wait until the problem is resolved.

- **Communication with large terminals.** In case of a hurry, it is sometimes possible to request the shipping line to offload a certain container first, however the terminals cannot provide any information about the time when the container becomes available for inland transport.

- **Payment issues.** For both export and import containers one of the reasons of delaying the booking of the hinterland transport is the payment issues between the sender of the goods and the receiver. For export the sender of the goods often does not allow to pick up the goods until the payment is received. Thus, the organizer waits until the moment the payment has most probably been accepted, 1-2 days before the transportation. If the shipper sends the goods before the acceptance of the payment, the bill of lading is used as a guarantee of the payment. It influences the behavior of the organizers concerning the import container: they only send the bill of lading at the moment they receive the payment, thus no inland transportation is possible until the shipping line releases the container.

4.6 Container terminal

The container terminal is a point of interaction of different parties involved in the sea container transport. Even from the perspective of the physical container flow, the container terminal connects the shipping lines with the barge, rail and truck operators. Nowadays the ships capable of carrying 8000 TEU (20 ft containers) are common, and the terminals have to be able to serve these mega ships. This section presents the discussion about the main activities of the container terminal and experiencing problems.

The clients of the container terminals are the shipping lines. The basic elements of the container terminal are depicted in Figure 4.2. The incoming vessels are unloaded by cranes, the containers are transported to the stacks where they are stored. When the inland carrier arrives, the containers from the stack are moved to the carrier and loaded onto it. This
Terminals with gantry cranes for container storage apply any kind of transport vehicles mentioned above. Even mixed systems of transport vehicles occur; e.g., multi-trailers for the quayside and straddle carriers for the landside operation. Up to now AGV terminals only exist in combination with automatic gantry cranes. Trains are normally loaded and unloaded by gantry cranes even in case of straddle carrier terminals, although in some cases straddle carriers are also used for this purpose (see Fig. 6).

![Figure 6. Container terminal system (schematic side view, not true to size)](image)

The decision on which equipment is used at container terminals depends on several factors. Space restrictions, economical and historical reasons play an important role. A basic factor is the dimension of the space which can be used for a terminal. If space is restricted, gantry cranes to store containers are preferred. A decision for AGVs and automated gantry cranes can be made in case of high labour costs and new terminal construction. Historical and cultural reasons have to be considered if container terminals are enhanced or modernized. Because space is becoming a scarce resource, a tendency for higher storage is to be foreseen.

Besides the mentioned two main categories, common in Europe and Asia, a third type, quite often in North America, is an on-chassis system, in which containers are stored on chassis instead of being stacked on top of each other. This system lacks of special stacking cranes, has simpler stacking logistics and is more space demanding. Its logistic aspects are covered by the other two systems.

### Literature review

Container terminal operations are becoming more and more important. Therefore, an ever increasing number of publications on container terminals have appeared in the literature. While we refer to most of them in the subsequent chapters, some deserve special mention due to some of their general perspectives.

Vis and de Koster [196] (with some 55 references up to 2001). An overview of relevant literature for problem classes like arrival of the ship, (un)loading of a ship, etc.

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**4.6.1 Sea side**

Prior to arrival of the sea-vessel, the berth must be dedicated to the ship. The arrival of the sea-ships is often known months in advance. The allocation of the berth is ideally done before the arrival of the first containers intended for this ship (Steenken et al., 2004) for optimal storage of the containers. Several quay cranes must be assigned to (un-)load the containers. The number of the cranes per vessel differs based on the size of the ship and on the number of simultaneously berthed ships. The containers are loaded onto the vessel according to the storage plan which indicates the location of the containers on the ship. The input parameters for the storage plan are: type of the container, its weight and destination. After the containers are unloaded from the ship they are transported to the yard area.

Even though the barges are a part of inland transportation, they still require berth time. Not every terminal has a berth dedicated especially for barges, the same holds true for the quay cranes. Thus barges are often processed at the same place by the same equipment as the sea-vessels.

**4.6.2 Yard**

The containers unloaded from the sea-vessel and inland transport are moved to a stack on internal vehicles (automated guided vehicles, trucks, straddle carriers (Vandaele, Bierlaire, Salani, & Vacca, 2010)). The containers are stacked in the yard by special cranes: reach-stacker, straddle carrier, rubber-tyred gantry crane, rail-mounted gantry crane (Brinkmann, 2011). The choice of the equipment is based on the size of the terminal, its main purpose, throughput, etc.

The yards of the large terminals are often split into different sections (Steenken et al., 2004). The reefer/damaged/empty containers, containers holding dangerous goods are often stacked separately. Also the place of the containers in the yard is based on the next transportation mode: different stacks are dedicated for different transportation modes. The berth length can exceed several kilometers, thus the import containers are placed near the
berth dedicated to a certain ship. Other variations of stacks are possible.

The time containers spend in stacks is called dwell time. Lu (2008) argues that the terminal capacity can only be improved by decreasing the dwell time because two other factors influencing the capacity cannot give the desired result: the size of the terminal cannot be expanded in a short time, and the higher stacks will increase shuffle and housekeeping moves. The dwell time depends on a number of factors: the availability of inter-terminal and hinterland connections, custom regulations of factors concerning the goods (Ottjes et al., 2007), characteristics of the supply chain in question (Lu, 2008). To limit the effect of the latter factors the terminals have introduced the ‘cargo opening window’ – an interval when the export container is allowed to enter the terminal. In case of APM terminal in Rotterdam this ‘window’ opens 7 days before the estimated time of arrival of the vessel (APM Terminals, 2012).

The first place of the incoming container in the stack is very crucial for the performance of the container terminal. Export containers are normally stacked in the way that the lighter containers are placed underneath the heavier ones so that they can be loaded first into the ship in order to guarantee its stability. The information about the following transportation method for the imported containers (the ones which are just unloaded from the vessels) enables the operators to place the container in the stack dedicated to that particular means of transportation and in the place according to time of arrival of the truck/train/barge. If it is not possible, the yard equipment must reposition the container to a right place when information becomes available. However, the terminals have limited resources, and the equipment working in the yard must minimize the moves of containers. The yard operators distinguish the following moves (Farró Barberà, 2009):

- **Productive move**: a move to bring into or out of the stack.
- **Shuffle**: a move to support a productive move, to move a container blocking another container.
- **Housekeeping move**: any move performed in order to improve the position of the containers.
- **Pre-positioning**: an anticipating move in order to place the container in an optimal position.

Only productive moves deal with the external world, all other moves support them. Pre-positioning decreases the time spent in productive moves, however the shuffle and housekeeping are unnecessary moves which reorganize the containers that were initially not stacked optimally, these two moves should be minimized for higher efficiency of internal operations.

### 4.6.3 Land side

Trucks and trains arrive at the landside. They are (un-)loaded by internal equipment. The operations associated with trains are similar to the vessels: there is a storage plan and the crane loads the containers according to it. It is common that the containers are pre-moved to the train loading location prior to the arrival of the train.

A truck enters the container terminal via gate-in (Steenken et al., 2004), where the data concerning the truck, driver, export/import container is checked. After that the driver receives directions to the place where the truck can pickup/deliver the container.
The problems of the container terminals are not discussed explicitly in this section due to the absence of interview data. The actors involved in hinterland transportation are discussed in more detail in this and previous sections. A more detailed analysis of the identified problems is performed in the following sections.

4.7 Shared Situational Awareness and Problems in Hinterland transport

The focus of this thesis is on the SSA in hinterland transportation. To understand the SSA in previous sections, the procedures and the problems of various parties involved in hinterland transport are identified. In this section, the SSA of the actors is discussed, and the problems which are presumably caused by the lack of SSA are presented.

All of the interviewees have been in industry for many years and have a clear understanding of how it works. Many of them have visited the container terminal and know how it operates. However, it is not directly translated into high levels of SSA. The problems for each actor are listed and analyzed from the perspectives of SSA. First, the general SA of the interviewed actors is discussed.

**Barge Operator.** Both interviewees have deep knowledge about the processes at the terminal. They are aware of the reasons of choices made by the terminals and their clients, which have an influence on them. The consequences of BO actions on others are known. They are also aware of how the information they provide is used at the terminal. They know how to deal with the problems. However, the exact procedures and problems which they encounter are unknown.

**Truckers.** The interviewee has a clear understanding how the container terminal operates, also he claims that other planners in the company also have the same level of knowledge. It is explained by the functional requirement, otherwise the planner cannot operate properly. However, the problems of the port are not completely understood. The understanding of the client processes is not deep.

**Organizers.** The terminal operations are understood to some extent, however based on the interviews, this understanding is prompted by personal interests of the interviewees. The situation of the carriers and their problems is less understood. Absolutely no awareness of the problems which the carriers experience due to their actions and the consequences of those is present.

**Container Terminal.** No interviews are performed with the representatives of the container terminals. Main terminals are very large parties. Shipping lines are the only clients they have. They do not have a lot of incentives to adjust their processes due to the problems of smaller parties involved in hinterland transport.

According to the description given in Section 3.3 and summarized in Table 3.1, the system level of the SSA in Hinterland transport is not higher than Level 1, Perception. However, the requirement of this level which states "Joint mission has to be established to have a platform for negotiations for an acceptable system goal" is not fulfilled by each actor. The mission of the hinterland transport is to efficiently transport the containers, however, every actor translates it to his own objectives, which can contradict the objectives of others. For example, an objective to decrease the processing time of the sea-vessel by the terminal leads to a congestion at the gate, which has consequences for the terminal’s dwell time. Further in this section, the problems in hinterland transport are presented from the perspective of consequences for various actors.
The following problems have been previously identified in this thesis:

1. Berth time given to the barge differs significantly from the requested one. This problem is caused by the terminal. In most cases time suitable for both container terminal and barge operator can be found, however, if not, all the parties involved in hinterland transport are influenced. Barge operator cannot pick-up import containers, thus the client can switch to another carrier. The export containers cannot be off-loaded from the barge, the barge operator needs to plan the actions to deliver the containers for a corresponding vessel on time. If this is not possible the containers miss the vessel. In both cases the client of the barge experiences inconveniences. Also shipping line loses money if export containers miss the sea-vessel. Container terminal is a client of the shipping line, thus the customer satisfaction drops. Not only customer satisfaction is influenced, also but also one of the container terminal performance indicators: dwell time increases for import containers that need to be loaded onto the barge.

2. Switch from one transportation mode to another for import container. The next transportation mode for import containers can be changed at the last moment. The previous problem can be named as a reason for that: a barge does not receive berth time, the next possible barge does not fit in the schedule of the forwarder, which forces him to hire a truck. Also the changed preferences of the end-client can lead to a sudden switch of the transportation mode. Physically it can mean that the container has to be replaced from the stack dedicated for one transportation mode to another. It costs container terminal additional moves.

3. Lack of certain details about the container (e.g. PIN code is missing). The causes of this can be different. It mostly concerns the bookings which are made far in advance, when not every aspect is yet known. It can happen that the client of barge operator does not upload needed documents to the terminal or forgets to provide the barge operator with the PIN code for picking up the container. In most of the cases the simple telephone call to the client and terminal resolves the situation, however, if all required paper work is not present upon loading of the barge/truck, the container cannot be loaded or unloaded to/from the inland transport. The consequences are the same as described for Problem 1.

4. Feedback (container terminal does not give feedback on the status of containers). This problem is worsened in case the carriers do not use IT system integrated with container terminal. It is common for container terminals with such systems to push transfer control of the status of the containers to the carriers (Problem 4), but in case if the systems are not integrated, they have to check the status constantly with the help of a web tool.

5. Waiting time for trucks at the gate. Waiting lines at the gate increase the expenditures of the truckers. As mentioned in Section 4.4, there are two reasons: a large number of trucks and the use of equipment from the land-side of the container terminal for the sea-side. The extreme long waiting times can cause containers missing the sea-vessel, this increases the dwell time for a container terminal (the container needs to wait for the next sea-vessel). The dwell time of import containers increases linearly with the waiting time at the gate. Another problem which can occur due to long waiting lines is the driver of the truck exceeding maximum allowed number of driving hours. In this case he has to stop and rest. Some container terminals offer a place in line for
resting. However, if only one driver is present further transport of import containers after the terminal visit is not possible. The problem with driving hours is caused by both container terminal and the planners of truckers.

6. Short planning horizon of trucks due to late order (details) arrivals. The planning horizon of barges for import is quite long, export is characterized more as a "last-minute business". In case of trucks, most of the orders are last minute. This can lead to inefficient capacity usage (Problem 6). This problem is caused by the organizers of transport. They prefer to wait until the last moment because of payment issues between the sender and the receiver of goods (Problem 7). Also customs can bring about unforeseen delays. For this reasons the organizers often choose an overprotective strategy. This behavior has also consequences for them, the carriers may already be fully booked. The increase of costs or transport time is inevitable in such a scenario. However, customs makes risk analysis based on the country of origin, the sender, receiver, the ports of visits. This information is available for the organizer and he can make his own estimation whether the container has a risk of being checked or not. The same holds true for the uncertainties about the payments between the shipper and the receiver. Based on the history and reputation of the parties the organizer can estimate whether there is a risk of not receiving the payment. If the result of both risk assessments indicates that the container is safe, inland carriers can be booked earlier.

7. Payment issues between sender and receiver of the goods. As mentioned in the description of previous problem, the forwarders prefer to wait until the last moment for booking of inland transport, even in cases when the order is booked several weeks upfront. The financial relations between the sender and the receiver are the cause of this problem. Shipper (for export containers) often does not release goods until he receives the payment. The same holds true for import goods, the shipping line requires an original bill of lading before it releases the import containers, the shipper of goods who has the bill of lading does not transfer it to the receiver of the goods before the payment is received. To prevent the situations when an inland carrier is at the location waiting for loading, which is not possible due to the payment issues mentioned above, the forwarders do not give the order to inland carriers at all until all issues are resolved.

8. Customs system failure. The customs IT system can fail and no customs documents can be received. The import containers cannot leave the terminal without the document and no solutions are detectable. Export containers often cannot enter the terminal without a customs document. The terminal saves money by not having a special stack of undocumented containers that should be separated from the other containers. However, truckers cannot offload the export containers and have to wait for the resolution of the problem. When it is resolved, many truckers want to visit the terminal, which causes longer waiting lines. The containers can miss a sea-vessel and customer satisfaction of the container terminal decreases.

9. Inefficient stacking of containers at the terminal due to the absence of information about the next transportation mode. One of the key performance indicators of the container terminal is the number of moves in the stack. Inefficient stacking increases the number of unnecessary moves. There are various causes of inefficient stacking, one of them is the absence of information about the next transportation mode for import containers and their pick up time. The organizers often know in advance what the next
transportation mode is. Barge operators, which are booked weeks before the arrival of the sea-vessel, also are aware of the next transportation mode. However, they never provide the information about it for the container terminal.

10. Long dwell times of the containers at the port. The dwell time of the container in the terminal is caused by various reasons which have already been mentioned in almost each problem discussed above. Another problem not uncovered during the interviews but mentioned in literature, is the fact that some organizers use container terminal as a free warehouse for a certain period. However, a container terminal has a limited stay time at the container terminal after which the container is removed from the terminal, the shipping line is also not interested in such activities, because they are in most cases owners of those containers. Many shipping lines provide the container free of charge before and after sea-transportation, if the usage period is overextended the organizer is charged.

11. Large terminals are not keen on helping in case of an emergency or a rush order. This problem refers to cases when a container needs to be urgently delivered to a client. In such cases the organizers try to contact the shipping line with a request to unload their container first. If it is possible the next challenge is to reach the container terminal and ask when the container becomes available. But as interviews have showed, container terminals are not keen on helping in such situations. The similar problem is experienced by barges if they have a rush order of a container already in the stacks. Large terminals start processing containers hours before the arrival of a barge at the terminal. Barge operator do not make money and the efficiency of barges decreases. The terminal dwell time increases. Also the end client has to make a choice: to perform transportation by trucks (winning speed) and pay more or to wait for another barge and have to wait longer.

12. Slot at which transportation is performed. The truckers can perform several orders a day. However, the choice of a time-slot can also influence their client, as the warehouses have fixed openings hours. If the trucker leaves late for the order and experiences a delay at the gate, he can deliver the container to the warehouse after the closing time. In such case the container cannot be processed on the same day.

13. After major disruption the truckers are expected to perform according to schedule right away. Sometime, major disruptions that stop the processes at the container terminal happen. The customers understand the delays in such cases. However right after the disruption is over, clients expect truckers to operate at a normal rate, which is not possible. The client in such case does not understand the situation that truckers experience.

14. Truck drivers forget to mention that they have loaded an export container, in such case the planners cannot pre-register the visit to a terminal. The last problem identified is the fact that situational awareness within a company can also differ. Truck drivers with installed GPS tracking systems often assume that the planners know exactly what the status of the driver is. Trucking companies register export visit at the terminal only after the container is picked up, and if drivers do not provide the planners with the information that the container has been picked up, the planners do not perform the pre-registration.
The problems mentioned above result in decreasing performance of actors, this can be expressed in KPI’s:

- Dwell time is one of key performance indicators of a container terminal, it is the time the container spends at the terminal.

- Number of yard operations. Not every move in the yard is inevitable, more information about the containers results in more efficient stacking, thus the number of housekeeping and shuffle moves decreases.

- Customer satisfaction of each of the described parties drops when the problems occur.

- Time/km ratio, this ratio expresses how fast the container is transported by the carrier, longer waiting times at the gate and increased time in port for barge operators in order to visit all the terminals decrease this ration.

- Failed transportation. It is not always possible for a barge to visit the terminal, which leads to containers not arriving at the terminal on time. Another possibility is that the import containers cannot be picked up.

- Capacity utilization. Truckers and barges towards the terminal are booked last-minute, which leads to capacity underutilization.

- Cost per container. The waiting lines at the gate, lack of possibility to unload the containers lead to extra costs for carriers, these include hiring a second driver for trucks, unloading the container at another terminal.

- Container transportation time. The total time container spends in the inland transportation affects end client.

Most problems one party causes for the other party have an indirect effect on the party causing the problem. Each actor is aware of the consequences of someone’s actions for him, however, it does not work the other way around. It should be noted that none of the interviewed parties take any action to improve the situation. Only large container terminals resolve their problems by employing power and making other actors adjust their behavior. While it has already been mentioned multiple times in this thesis that the lack of SSA is at the root of these problems; it has not yet been explained how the lack of SSA causes these problems. This link is established in the following section based on the example of hinterland transport.

### 4.8 Linking problems to Shared Situational Awareness

Previously in this thesis the problems occurring in inland transportation have been linked to a lack of SSA. However, the link between the lack of SSA and the problems has not yet been explained. This section eliminates this gap. To facilitate the analysis, the figure from Section 3.1 is repeated in Figure 4.3. It concerns individual Situational Awareness, however, it is also applicable to this section.

Problem 9 is picked and based on this problem the link is presented. Barge operators receiving the import order weeks upfront do not inform the terminal that a barge is the next transportation mode. The container terminal cannot efficiently stack the import containers due to the absence of the information about next the transportation mode. Thus we arrive
at the situation that the action (not providing the container terminal with information) is not correct (not ideal). Based on Figure 4.3 this can be caused by wrong (not ideal) decision making, individual factors or system factors. This action does not require any complicated calculations, thus the individual factors do not influence the action. The limitations of the system that withhold planners of barge operators from informing the container terminal about the next transportation mode are not found. Thus, this wrong (not ideal) action is caused by decision making.

There is no evidence that information about the next transportation mode is withheld from the container terminal on purpose. It does not hamper either personal interests of the planner or companies, container terminals do not compete with barge operators. It is not likely that other individual or system factors are at the root of this decision either. The explanation of this action is that planners are not aware that this information is necessary for a container terminal. Planners are never asked to provide this information, it is not a part of their protocol. Thus the lack of SSA of a barge operator causes problems for container terminals.

The presented case is relatively simple; the action and the decision phases are (almost) not influenced by the other factors from within or from outside the companies. In other cases these factors do play a role, as for example for Problem 1, where the berth time for barges cannot always be found due to such reasons as simultaneous arrival of several sea-vessels, a large number of barges, breakdown of sea-side equipment, etc. However, without the understanding of problems this action can cause for barge operator, the container terminal will never feel the need to address it, leaving the problem as it is right now.

We arrive at a conclusion that the right action cannot be performed without a right decision which cannot be made without sufficient SSA. However, a sufficient SSA does not guarantee right decisions and actions, because other factors play a role in the decision making.
process and action execution phases. In Figure 4.3 the Action output is used as an input for Situational Awareness. Thus, if an action results in a problem, SA changes. However, in case of hinterland transport the parties causing and experiencing problems are different, meaning that this mechanism does not give feedback to the party causing the problem. This analysis can be used to modify the Endsley’s model (M. R. Endsley, March 1995) for our case study of two actors as is shown on the left side of Figure 4.4. To solve the problems actors need to communicate and share the problems with each other in order to increase the SSA (P. M. Salmon, Stanton, Walker, Jenkins, & Rafferty, 2010), this results in a Communication block on the right side of the Figure 4.4 in which a desired situation is depicted. However, not only the problems should be communicated to each other, but also plans and actions (Kurapati et al., 2012) in order to reach the second level of SA.

This need for sharing a situation in order to increase SSA has been identified a long time ago in other fields. In army (Jameson & Stoneking, 2002; Farrell, Jameson, & Stoneking, 2003) and emergency situations (Harrald & Jefferson, 2007; Krohns-Välimäki, Strandén, Hälvä, Verho, & Sarsama, 2013) the research does not focus on the need of sharing information, it is often rather obvious in these fields. It concentrates on which information should be shared and with what parties, how this information should be filtered, represented, etc. The level of communication required for hinterland transport is smaller, however due to independency of actors the process of sharing the situation is not even identified as a requirement by the involved actors.

The next question is how to initially begin the communication process in hinterland transport. It can be translated to an objective for game design: the game should show the difference between not communicating and communicating with respect to game performance of individual players.

### 4.9 Sub-conclusion

This section discussed the actors involved in transportation. The actors that are most interesting for the research are Transport Organizers, Barge and Truck Operators and Container terminals. Each of the actors has been studied in more detail by performing a desk research and interviewing the representatives of the industry. The following parties have been interviewed within this project: 2x barge operators, a truck operator, a shipping line agent and a forwarder. No contacts could be established with container terminal, however, it did not have a lot of impact on the project due to the abundance of this topic in literature.
The last sections uncovered and analyzed the problems of inland actors. The link between a lack of SSA and problems was identified. It has been shown that SSA can be increased by communicating to each other about the problems, plans and actions. This conclusion on communication was used to derive an objective for designing the game: the game should show a difference between not communicating and communicating with respect to game performance of individual players. Also the discovered procedures and problems of actors can be used in game design process to make the game realistic.
Previously in this thesis the inland transport from and to the Port of Rotterdam is discussed, the actors involved in the inland transport are presented. In previous chapter the analysis is done on the operations and behavior of the organizers of the transportation, truckers, barge operators and container terminals. The problems that the actors encounter are identified. One of the causes of these problems is a lack of Shared Situational Awareness. In the last section of the previous chapter the communication is identified as a key element to increase SSA, and this is used to derive the objective for the game session.

In this chapter the design process of a game session is presented, which corresponds to all three phases of the Design flow as presented in Figure 5.1. The key element in the game session is the game, other elements of the game session support the effect of the game. After the structure of the game session is presented, the focus is fully shifted to the game design process. First, the analysis is done on what aspects of the reality to include into the game. From this analysis the needed learning effect of the game is derived. The requirements on the game aspects such as structure, time, elements are posed.

The Game is designed according to Triadic Game Design development model discussed in Section 2.3.3. The first round, different game concepts are proposed, (Phase I in Game Design flow). From four alternatives one is chosen, which is detailed further in Round II of the design (Phase II). The game design process is not fault-proven and the iterations in the design are required. In Round II the game is designed and tested. Based on the results a new version of the game is designed and again tested and so on, until the game satisfies the requirements and learning objectives. The final design is produced after Round III (Phase II).

Figure 5.1: Research Steps: Game Design Process.
5.1 Game session structure

The game is chosen to be a main tool to increase shared situational awareness. The game session is led by the game master whose responsibilities are to facilitate the learning effect. The game is accompanied by a small introduction lecture on the hinterland transport and Shared Situational Awareness, which is given by the game master. If players have any questions regarding the presentation or the topic of presentation, the game master clears it during a short discussion. The next step in the game session is the introduction to the game: the game, the purpose of the game, the idea and the rules should be briefly explained, this phase should be backed up by the game manual. The step four is playing the game, during which the game master has an extensive responsibilities from controlling the execution of the game rules to evaluating SSA of the players. At the end of the game the discussion is planned in order to discuss the results of the game. During this discussion the learning effect of the game should be evaluated.

5.2 Reality and the game

In this thesis the model of the reality of the hinterland transport from/to container terminals is presented, where several assumptions and generalizations are made about the reality. In this chapter this model is used to design a game. However, not every aspect must/should be included in the game. Some of them has no effect on meaning of the game, some can lead to extreme complexity of the game.

Kriz (2003) describes this transition from the reality to the game model as Reality levels. He distinguishes five Reality Levels in the game design. Regarding to the topic of this thesis, Reality Level 1 is the reality of inland transport, which is reduced and simplified in the game to Reality Level 2. Players of the designing game create Reality Level 3: by playing the game they influence and change Reality Level 2 by their behavior, their state of mind, etc. As it is pointed out earlier in Chapter 2 the game must be ended with the debriefing, which compares Reality Level 1 and Level 3 realities with each other, creating Reality Level 4. The problems simulated in the game should be linked to the real problems of the container transport. The actors performance increase due to higher levels of SSA in the game should be linked to the solutions of the problems in the reality. Thus, Level 4 influences Level 1 reality. During meta-debriefing (Kriz, 2003), or debriefing of debriefing, and the game results are evaluated based on the effect of the Reality Level 4 on Reality Level 1. In case of unsatisfactory results, Reality Levels 2 and 3 must be adjusted.

In this section the transition from Reality Level 1 to Reality Level 3 is described. The actors which have to be included in the game are identified. This work is similar to work described in Section 4.1, where the actors are chosen for more detailed investigation, in the following section the same work is done from the perspectives of the game design process. The list of the problems presented in Section 4.7, which these parties encounter due to each others actions, is analyzed and the learning objectives of the game are identified.

5.2.1 Game Actors

Barge operators, truckers, container terminal and organizers are identified as main owners of the problems which are caused by the lack of SSA. These parties are crucial for the hinterland transport, so each of them is chosen to be actively played in the game. There are different types of organizers: shipping line agents, forwarders, expediters, etc. Their
activities and focus differ per type, however from the perspectives of this project they all can be seen as organizers. In the game it is chosen to combine all the organizers into one player.

Another representative of the physical transport Rail Operator (RO) is quite separated from the rest of the actors. As already mentioned in previous chapter, RO does not experience problems associated with entering the container terminal (as waiting lines for trucks and berth time for the barges). The discharge and load list problem does not differ from the BO. At the same time RO are relatively large and there are few of them. Hence, they have substantial bargaining power in negotiations with Container Terminal. Thus, RO is not included in the game.

In Section 4.1 the customs is identified as the most crucial actors from the authorizing group. The importance of the customs is obvious, however it is not an independent actor, it has pre-determined set of rules, which are publicly available. For the game customs is chosen to be simulated but not played, thus its presence is incorporated in the game rules.

The sender and the receiver of the container have the important role in the hinterland transport. The relationship between them, especially financial aspects, influence the hinterland transport significantly. However, they are not directly involved in the transportation and it is chosen to simulate the actions of the clients of the transportation passively in the game.

Other parties such as banks, insurance companies, port officials, labor unions, various governmental officials (except Customs), etc. are not found to be having a lot of direct influence on the hinterland transport and for this reason are not included in the game.

To sum up in the game four types of actors should be present: barge operator, truckers, container terminal and organizers. Customs and end clients of the transportation must be simulated in the game but not actively played.
5.2.2 Problems from the reality to the game

In previous chapter the SSA is identified as a cause of several problems in the hinterland transport. The objective of this thesis is to increase SSA, however it cannot be simply taught, this concept has to be understood by the players. The understanding, the awareness, can be reached by letting the actors experience the problems. To increase SSA it is chosen to include in the game the problems from the real life, which are caused by the lack of mutual understanding. By showing the causes of these problems and their effects on various actors, the SSA should be increased. In this section the problems identified in Section 4.7 are analyzed from the perspectives of possibility to implement them in the game and their learning effect on the SSA.

From the problems list presented in Section 4.7 some are difficult to be implemented or have low potential learning effect:

- Lack of feedback from the terminals (Problem 4) worsens the situation, however, it only concerns parties which do not use IT systems integrated with the container terminal systems.

- The failure of the customs IT system (Problem 8) does not happen often, and the problem is often resolved quickly, there is no use to include this into the game, it only decrease the reality effect of the game.

- The long dwell times (Problem 10) of the containers decreases the performance of the container terminals. However, identified causes of the long dwell times are mentioned in other problems from the list mentioned in Section 4.7. The use of the container terminal as a free warehouse is not backed up by the information from the interviews, so it is decided to not implement this problem in the game.

- Time slot at which transportation is performed (Problem 12) can cause problems to the warehouse in case of import container, or lead to the missing of the sea-vessel for the export containers. However, as explained previously this problem is a derivation of the truck waiting times at the gate, the time-slot of the transportation is often discussed during the booking. At the same time this problem requires a division of the game days into the hours, what brings a high level of the complexity to the game.

- The expectations of the clients after the major disruption (Problem 13) do not have consequences for the transport itself, but shows the level of the SSA in the system. This problem is difficult to simulate in the game which focuses on everyday activities and also major disruptions do not occur often.

- The problem with the truck drivers, that forget to inform the planners about the departure towards the terminal (Problem 14), which leads to the fact that the trucks visit is not pre-registered, is more relevant for the Team Situational Awareness, also its consequence is small, the late pre-registration does not have any consequences for the truck, till the moment it is at check at the gate.

The above mentioned problems are not included in the game. The rest of the problems can serve as a good learning material for SSA and thus can be used in the game.

To sum up in the game four actors are included to be played actively, certain actors should be embedded in the game rules and game mechanics. However, there are a lot
of parties which are not included in the game. The same holds for the problems of the hinterland container transport. It is expected that not-included elements will only have minor influence on the reality of the designing game. After the final game tryout the realism factor of the game should be included in the final evaluation.

5.3 Objectives of the game

In Section 4.8 the main objective of the game is derived: the game should show the difference between not communicating and communicating with respect to the game performances of the individual players. It is assumed that communication will lead to increase in SSA. In Section 2.3.3 three aspects of serious games are presented: Reality, Meaning and Playability.

The Meaning of the designing game is to show the effects of increased SSA on the everyday performance. In previous chapter the level of the SSA in hinterland transport is analyzed and according to framework presented in Table 3.1 corresponds to the Level 1, Perception: the actors have a common high level goal. Level 2, Prescription, is set as more detailed objective. The players should understand the benefits of monitoring each others plans and actions. This can be done by pointing out that existing problems can be minimized or resolved by higher levels of SSA, what requires extensive communication. Thus, the game should include existing problems which are caused by the lack of SSA, demonstrate their effects on different players, and show the positive effect of sharing and understanding the situation of each other.

The Playability is a must for the games. If a game is not playable or very difficult to play, the chance is small that anyone will ever play the game. To have a playable game it has to be challenging, fun and easy to understand and play.

The Reality component in this case means, that the game flow should look like a hinterland transport, which is described in previous chapter. The designed game must simulate the every-day activities of each party, however the problems, which occur in real life, must have accelerated rate of occurrence compared to the reality to let the players experience them.

These three objectives are interdependent: high scores for one objective results in low scores for other. Further these objectives are used in game design process.

5.4 Requirements for the game

The next crucial step in design is to list all the requirements. During the discussion within the working group the following requirements are posed on the final game design:

- No special training is needed to play the game. The professionals, which are the target group of this game, do not have a lot of time to invest in the game itself, especially in the training for the game.
- The playing time should be limited to 3 hours.
- No complicated calculations which require the use of computers are allowed to be in the game.
- Only one game master. No additional literature except this thesis should be needed for preparing the game session.
• The game master should not be involved in the game flow. His tasks should be limited to: controlling the execution of the rules, observing the players, explaining the game objectives, evaluating the game.

• No more than 6 players are allowed: large number of participants is more difficult to manage and to observe. At the same time it brings complications to the design process due to increased complexity (more players – more interactions – more game attributes) and during the tryouts, for which the crucial aspect is to find the participants.

• The positive effect of higher levels of SSA should be quantitatively seen back in the game results.

• The comparable activities and the results for each player.

• It should be possible to learn how to play a game within 10 minutes.

• Each player has to have the same load during the game.

• The aspects of the game which are associated with the Shared Situational Awareness should be easy to observe.

• High levels of SSA have to be translated to the better game performance in any case: collaborative and cooperative game playing should lead to higher results than individualistic behavior even with a luck factor.

These requirements together with the players experience, and game results are used to evaluate the game after the final tryout.

5.5 Round I: Choosing concept

The game design process consists of three rounds as explained in Section 2.3.3. In Round I the game concepts are proposed and one of them is chosen to be further detailed in the next round as depicted in Figure 5.3.

Logistic games are popular (D’Amours & Rnnqvist, 2010; Battini, Faccio, Persona, & Sgarbossa, 2009; Welters, 2005). Basically the designing game does not differ from the logistic games where the players represent different elements of the supply chain. As in the popular beer distribution game (Sterman, 1989) the containers in inland are transported from the sea to the land. The container terminal is the one element in the chain, the inland transportation is the following element. In hinterland transport the containers are also

![Figure 5.3: Game Design: Round 1.](image-url)
moved in the reversed direction, what can be seen as ”return” for the standard logistic games. However, the similarities stop at this point. In the hinterland transport the organizers of the transport are not involved in the physical movements of the containers, they give the orders to the chain, they control and monitor the activities in the chain. The other difference is that the actors have totally different objectives. In the standard supply chain game all players have similar objective ”to buy/produce the certain number of goods which matches the sales”. In the hinterland transport the objectives are different for each actor as described in the previous chapter, this leads to the difference in the activities of each actor. The objective of this thesis is not to simply show the processes of the container supply chain, but to increase Shared Situational Awareness.

Game increasing SSA is not a new topic (Perla et al., 2000; Hasan, Warne, & Mitchard, 2007; Teng et al., 2013), however, no literature is found on games for SSA in supply chains. Thus, new concept has to be developed in order to reach the objective of the game. During this round, different game concepts are proposed based on the works presented by Waitelonis, Ludwig, Knuth, and Sack (2011); Herbert (2012); Rollings and Adams (2003); Harteveld, Lukosh, and Kortmann (2009); Oblinger (2006); Egenfeldt-Nielsen (2007). The most promising ones can be categorized in four game concepts:

1. Quiz game. Players are divided into three groups. Each group receives the description what they are and what/how they do. Then the teams are made, each team has players from all groups. The game has a form as a tv quizzes: the teams are asked to answer the questions or perform some actions. For each action they can gain points. The number of points is related to the level of cooperation between the players within one team.

2. Board game. The game is played on the game map: there is a start and finish. The player, team of player, which reaches the Finish first, wins. Each player has its own type (one of three), to reach the Finish line more efficient, the knowledge of each type is needed.

3. Card Game. Different types of players receive different Cards. The cards can/must be played in certain situation to complete some tasks. Certain cards can only be played after the execution requirements are fulfilled. The game ends when the certain cards are played. However, the fastest way to play these cards require extensive cooperation between the players.

4. Role Game. This game is played in a large room, where players receive the number of the containers which they need to transport from one side of the room to another. Different types of players perform different roles and have their set of allowed actions.

The discussion within the working group showed that none of the concepts can reach the objectives of the game:

- Quiz: it is difficult to translate the quiz activities to the reality, meaning that the players would not feel a link between what has been done in the game and the reality, resulting in zero learning effect.

- Board game: the different actors from the reality must have the same objectives in the board game so that they can compete with each other. However, the activities and the objectives of the chosen actors does not have much in common.
• Card game: to play effectively the card game, the players should know all their cards, also they have to understand the effects of each card. This requires a lot of memorizing (Oblinger, 2006) from the players, what can distract players from the game flow and decrease the meaning.

• Role game: the interesting concept, with a lot of interactions, however, the problem associated with this concept is willingness of the players to participate in such physical interactions.

Instead of using one concept, it is decided to make a mix of all of them. The transport orders are processed by the container terminal and the inland carrier, while the organizer has to distribute the orders between the physical transport actors. The concept should be seen as a board game in which each player has its own objectives and own activities (as in role game), the certain aspects of interactions are performed by means of the cards (card game). The elements of the quiz can be used during the game for different purposes: exploring the game, evaluating the game, etc.

5.6 Round II: Game versions

In this section the chosen concept is further detailed. The chosen game design approach expects multiple iterations in case if the designed game does not satisfy the objectives as depicted in Figure 5.4 and explained in Section 2.3.3.

During a game design for this round the game failed to pass the evaluation after building, thus the game is redesigned and built again. Each new version is based on the experience learned during the testing of the previous version. Thus, according to Reality Levels presented in Section 5.2, each game version is built (Level 2), played (Level 3), debriefed (Level 4) and evaluated (Level 5). At the Reality Level 5 the decision is made, whether the game reaches the objectives and satisfies the requirements. If not, the Reality Level 2 and 3 are adjusted and the game is played again.

About 10 different game versions are designed, however, the difference between several of them is small and concerns only minor design choices. Three main versions of the game can be distinguished. Further, in this section the criteria used to evaluate the game versions are presented and then these versions are explained together with the link between one version and others. For ease of understanding the difference between the versions, for each of it the

![Figure 5.4: Game Design: Round 2.](image-url)
following topics are described: General idea; Players (Player 1, Player 2, ..., and Player #), Game Structure, Learning Effect, Test Results, Conclusion.

5.6.1 Evaluating the game versions

The conclusions about the game versions are based on the try-outs. In each played version the designers of the game evaluated all three factors of the game: playability, reality, and meaning.

The reality factor is analyzed twice for each game version: before the game, thus, evaluating the designed realism and after the game, how real the played game has been, as the players influence the game state by their behavior (Kriz, 2003). During the try-out the designers of the game analyze the playability and meaning by observing the following game aspects:

- how fast players learn how to play;
- how often players ask for help from the game master;
- intuitiveness of actions for players;
- the main activity of the game master;
- number of collaborative decisions taken by the players;
- the increase in the game performance indicators with the increase of SSA;
- the work load between the players;
- rules followed by the players and not;
- procedures according the rules or as agreed;
- game items used by the player and not;
- players interest in the game.

No quantitative scores are given to the game, the comments for each of these aspects are given. After the game the evaluation is made whether the game satisfies its objectives. Ideally, the tryouts should be performed with the target group, with different level of knowledge about the subject: for example, junior planner and senior planner working at the barge operator. However, it is not possible to perform this kind of tryouts within the scope of this project. Instead, internal tests of the game are performed with the students of different studies. Hence, the obtained results from the tryouts are biased by the composition of the participants and this bias should be taken into account for the analysis. Photos from different tryouts can be found in Appendix B.2.

5.6.2 Version 1

1. Description. The first version of the game is intended to be as realistic as possible. The idea behind that is based on the belief that realism of the game can attract attention to the game and it can increase the credibility of the game in the eyes of professionals. The main activity of the game is executing the transport orders. It should be noticed that in this version of the players, the players operate only with
action cards, information cards, schedules, order cards, capacity tables, boards, etc. They do not move anything physically. This idea is based on the fact that the planners do not physically interact with the containers, they only give orders to perform a certain action. Each action is executed by means of an action card.

2. **Players.** There are four players: truck operator, barge operator, container terminal and forwarder, each having its own extensive set of attributes

   (a) **Forwarder.** Forwarder has a set of orders for each day, when he picks orders, he must arrange transport releases and give a transport order to the inland transport operator according to the schedule of the sea-vessel on which the container enters the port or leaves the port. Each order has the direction (export/import), the land time, sea-vessel name, number of the containers and the customer name. The process of requesting the transportation is done by filling in the request cards. If the inland transport is booked, transport operators and container terminal execute steps representing the physical movements of the container from/to the inland warehouse to/from the sea-vessel.

   (b) **Barge Operator.** Barge operator has 3 barges, which operate on a fixed schedule: the day part at which the barge leaves the land and container terminal cannot be altered. The trip to terminal takes 36 hours, trip from terminal takes 60 hours (due to river flow). Each barge has a capacity of 15 containers. When the order is received from the forwarder, barge operator checks which barge can deliver the order according to the given deadlines, and, if possible, available the capacity at the barge for transporting this order. The operator needs to register the order in his documentation. When a barge arrives to the container terminal it has to submit the loading and discharge lists and request berth time. The barge uses the same berth as the sea-vessels, hence the container terminal has to fit the barge visit into the sea-vessel schedule. It is not always possible. In such case the barge has to unload the container at different location and book a truck for completing the order.

   (c) **Truck Operator.** Truck operator has 5 trucks, each capable of transporting 1 container at the same time. In one the day a truck can perform 2 trips from or to container terminal, execution of one order takes one third of a day. The truck needs to pre-register its visit to the container terminal by notifying Terminal operator about the containers it is delivering or picking up. When the truck enters the terminal, it receives a notification from container terminal about the waiting line. Both barge and truck operators can choose to transport orders given by an external party (not Forwarder).

   (d) **Container Terminal.** Container Terminal has land- and seasides. At each side there are 2 equipment units, which handle the containers moves. At the land side it serves the trucks, and at the sea-side it processes berthed sea-vessels and barges. These equipment units can be moved to other side in order to increase the processing speed at that side, however the processing speed drops accordingly at the other side.

3. **Game Structure.** The game is meant to be played in days, which are subdivided into day parts: morning, afternoon, evening, and night. During each day the players have a set of actions which they are allowed to perform. The actions are executed in parallel.
There are two rounds, in the first round the players are not allowed to communicate with each other, in the second round they are allowed.

4. **Learning Effect.** The learning effect of the game is connected to bonus/reward system. The punishment reward system is linked to some actions or inactions. Each time a player performs a wrong action, he needs to pay a fine. If he performs right action, he receives a bonus. However, to perform the right action the input from other players is required. The idea is that in the first round the players spend more money on unnecessary actions, while in the second round they receive a lot of reward.

5. **Try out.** Try-out: Players: 4; players knowledge about the topic: zero (students of irrelevant for this project studies). The try-out of this version of the game started as planned by introducing players into the topic. Explaining the basic rules took longer than expected. However, after the game started, the problems began to arise. Each step was not intuitive for the player even after reading the game manual. The players were lost in the game attributes. As an example, barge operator had a schedule for each barge (3 in total), loading list for each trip (around 6), action cards (round 10), sea-vessel schedule, external orders stack, incoming orders from the forwarder, information cards. The rest of the players had the comparable number of attributes. As a result the game could not be played even for a single game day. The try out was stopped with the conclusion that the current version game is not playable. The reality should be stripped out, only the important for the learning objectives game aspects have to stay, the irrelevant aspects have to be removed.

6. **Conclusion.** The conclusions of the first version of the game are:

- The container as a main objective of the container transport, has to be visualized.
- Transport units and container handling steps have to be visualized to give a visual support to the players. It also helps to remember the game state: number of containers in the game, where the containers are, at which step they are, etc.
- The difference in the capacity and speed of the barge and trucks is not relevant to the game, each transport unit can carry one container at the time.
- Both barges and trucks can be played by one player.
- The subdivision of the days into day parts increases the complexity of the game and does not have any influence on the learning objectives
- Barge and trucks schedules require too much attention from the player. Instead, the path between the inland warehouse and container terminal should be visualized, the transport alternate between the warehouse and terminal.
- Parallel actions of each actor are difficult to observe and analyze for the game master.
- Mechanism for the key components of the game must be simplified: order requesting, information cards, berth time requests, container registration.

5.6.3 **Version 2**

The conclusions from the first game versions are used as an input for the second version of the game.
1. **Description.** In this version of the game, most of the things are simplified so that the playability of the game goes up. Besides, there are physical transport units and containers, which support the player. Most of the action cards which were supposed to be used on everyday basis are replaced by the real actions: putting the container into the transport unit, moving the transport unit. The action cards used to exchange the information and to handle the events are remained. The game map consists of: sea-side, container terminal, land and warehouses. The export containers must be transported from the warehouse to the sea-vessels (which visit container terminal), while import containers other way around.

2. **Players.** There are 3 players: Forwarder, Transport Operator and Container terminal. In general all the tasks are the same for all players as in previous version. However, the main focus of the players are now at the containers.
   
   (a) **Forwarder.** Forwarder pulls the orders out of the orders stack and at the same time he puts the container units to the incoming sea-vessel for import orders and on the warehouse for the export orders. To make a transport order he gives the order card to the transport operator.
   
   (b) **Transport Operator.** Transport Operator goes back and forth between the container terminal and the warehouse. He picks the container which are ready for transport from the warehouse and from the container terminal. Each transport unit can carry one container. The route from the warehouse to the container terminal takes 3 days. Before entering the container terminal the berth time should be granted for the barge, the truck visit needs only to be registered.
   
   (c) **Container Terminal.** Container Terminal has its own map on which he operates. It has several places (stacks) where the containers can be stored, each stack is for certain types of containers. Container Terminal processes export and import containers by moving the containers from one stack to another. The sea-vessels visit the container terminal each 2 days, they need to be also processed. The terminal has limited number of actions which he can perform each day.

3. **Game Structure.** The game is meant to be played in days as in the previous version, however there is no subdivision into day parts. The players play sequentially: Forwarder, Transport operator, and Container terminal. The two round system remains.

4. **Learning Effect.** The principle of learning effect of the game is the same as in the previous version. However the bonuses and rewards are linked to slightly different actions.

5. **Try out.** This game version was tested several times with slightly different game rules. For each try-out three players are invited. 9 people have participated in try-outs of this version of the game. Try-out is held as described in Game Session Structure section. This time the players were able to play the game. However, the number of troubles were encountered:

   - The learning effect was not reached at all due to the fact that the game money was only used for punishment reward system. The players did not feel the need for money, they were completely detached from it. Hence, when the game master notified about the punishment, the players did not experience it as something bad.
The players could see each others activities as the game map was open. This is already the increase in SSA compared to the reality, where the actions of each players are isolated.

Remained action cards were not used, the players pronounced the messages instead.

The game rounds are not convenient: players made negative comments when the game was stopped and reset to the starting condition with different rules.

Sequential game play which implies that each player waits until the previous player ends his actions is desirable only during the beginning of the game when players do not yet understand the game mechanics and require a lot of assistant from the game master. After several game days, the players showed (almost) complete understanding of the game rules and do not require (almost) any help from the game master. This resulted that the waiting time for the turn was experienced by the players as boring.

Despite the fact that this versions was playable, the players had a lot of struggles to play the game, they kept asking a lot of questions concerning the game attributes and mechanics at the beginning of the game.

There was a significant difference in the payload of the forwarder and the two other players. The number of possible actions a day of the forwarder was significant less compared to other two players. Also container terminal and transport operator had a lot of interaction with each other leaving the forwarder outside of the game. This imbalance led to disinterests from the player who was playing forwarder.

6. Conclusion. The second version of the game showed significant improvement compared to version 1. However, there are several shortcomings which need to be overcome:

- Game money should be linked to all activities to show the value of the money.
- Game must have more intuitive procedures, more hints on the map.
- Remained action cards must be removed.
- The players activities at the beginning of the game should be not visible for other players.
- Game should not be separated in the game rounds. It should be played in a constant flow, where at certain point the rules change.
- The sequential game execution is only desired during the beginning of the game to teach the players how to play the game, after that the players should execute their daily actions in parallel.
- The game should start with the test round in order to give the players opportunity to learn the game.
- The role of Forwarder has to be extended to balance the workload.

5.6.4 Version 3

The version 3 is designed based on the results obtained from try-outs of the previous versions of the game.
1. **Description.** The idea of the game is the same as in version 2, the following main differences are made in the game design: 1) money is linked to all activities of the players; 2) the forwarder is renamed to shipping line agent and has more tasks to do, 3) there is only one round; 4) the action cards are removed.

2. **Players.** There are 3 players: Shipping Line Agent (forwarder), Transport Operator (inland carrier) and Container Terminal.

   (a) **Shipping Line Agent.** Shipping Line Agent has all the forwarder tasks which are described in version 2, but he has additional tasks: arranging sea-vessel arrival to the container terminal. He sends in advance the discharge and load lists to the terminal.

   (b) **Transport Operator.** The tasks of the transport operator are the same as in previous version.

   (c) **Container Terminal.** Container Terminal performs the same activities within the terminal, the interactions with Transport Operator remain the same. However, in this version the arrival of the sea-vessel is in hands of Shipping Line Agent.

3. **Game Structure.** The structure of the game is changed. Instead of having multiple rounds with different rules, this version has only one round. After certain amount of game days the rules are changed in order to increase SSA. In this version the game is played at the beginning sequentially till the moment that the players understand the game rules. After that they play in parallel. The lack of the control during parallel execution of the game is compensated by the trustfulness of the game players, which can be assumed during the tryout with the representatives from the industry.

4. **Learning Effect.** In this version money is linked to all the players actions to give them the feeling that money matters. During the beginning of the game, the game players activities are not visible to other players, the game maps are separated by the wall what can be linked to the lack of SSA. In later phases of the game the removed wall and the increased communication leads to higher SSA and better game performances.

5. **Try out.** Try-out is held in the same way as for the previous version. The players showed the interest to play the game till the end. The whole game is played within one round, where at the certain point the wall and the rules were changed, this did not cause any irritations from the players and the change in the game rules was intuitive. At the beginning of the game the placed wall between the players caused a lot of problems for the players: they did not know the position of the containers, what happens at the other side of the wall, etc. After the wall was removed and the game rules changed, the players performances increased. The switch from sequential playing to the parallel led to the increased execution of the game and resulted in more fun for the players. All the game rules were followed due to the self-control of the actors.

6. **Conclusion.** The third game version showed satisfactory results. This version of the game is chosen to be a final version.

These three versions of the game represent the evolution of the game: from totally not playable version to the game which is interesting to play. However, due to the composition of the players, the effect of the Reality Levels 2, 3 and 4 on the Reality Level 1, or the learning effect cannot be evaluated. Additional tryout with the industry representatives is required.
5.7 Round III: finalizing the game

The game versions played in previous round are designed and built to be played internally within the working group. This internal testing have a number of assumptions which are not valid for the external tests: the game attributes are visually not attractive, the game manual assumes significant knowledge from the game master, the game attributes are made not from long-lasting materials, etc. In this round the transition of the game from prototype to end-product is explained.

**Manual.** Game manual used during the internal try-outs is not meant to be read by external public. The changes which should be made in it concern addition of the figures, changed lay-out, rewritten text, etc.

**Game Attributes.** During previous round, no attention is paid to the attractiveness of the game attributes, all the game attributes are made by means of scissors, glue and black&white paper. Final version of the game requires to be visual attractive. In this round the game attributes are redesigned. The cards are laminated to increase the life-time.

**Map.** The game map in previous rounds consisted of multiple colored A4. In this round the map is printed on one piece of paper and carton is glued underneath in such a way that the whole map can be easily folded.

**Game Box.** The game requires a certain package in which it can be safely stored and transported, the box is made during this round.

5.8 Sub-conclusion

In this chapter the game design process is explained. The learning effect of the game can be increased by organizing the game session instead of a single game. The structure of the game session is: lecture on topics of SSA and inland transport, discussion, introduction to the game, game and after game discussion.

The discussion on the following topics is presented: explaining the link between the real world and the game world, selecting the actors which have to be played actively, passively or not be included in the game. The certain aspects of the reality are included in the game based on the evaluation of their contribution to the game meaning. The next step described in this chapter is translating the project objective to the game objective and posing the requirements on the final game design.

The game is designed in three rounds. In the first round 4 different concepts for the game are proposed. It is been concluded that none of the concepts can satisfy the learning objectives, instead the mix of all the concepts is proposed, which is further detailed in Round II. The game design is not fault-free process: the game is designed, built and tested, and based on the feedback the new version of the game is designed.

About 10 different versions are designed, however, several of them differ slightly from a previous version on some particular aspect. Three main game versions can be distinguished. In first versions the reality was very high, and there was very little visual support for the players, what resulted in the version which could not be played. The reality factor of the game is decreased in the next version by removing all the aspects which do not contribute to the learning objective. Also visual support is added by introducing the physical map, physical containers and transportation units. This version was playable, however the players were constantly asking questions during the beginning of the tryout. The learning effect was linked to the game money. However, this money was only used when the player performed a
wrong action, and was completely detached from the game process. This resulted in players disinterest for saving money, thus the learning objective could not be reached. Waiting time for the own turn led to the boredom for players. The possibility to see each others actions from the beginning resulted in increased SSA compared to the reality. Also this version of the game showed that the imbalance between players load and between their interactions. In the third version of the game, the visual support for the players is improved, the money is linked to all game aspects, so that the players have an urge to save money. The game play changes to the parallel after the players understand the game mechanics. The activities of the players are hidden from other players by the wall during the first half of the game. The imbalance between players load is removed by introducing additional tasks to some players. This third version of the game is successfully played, and the game objectives are reached during this game.

During the last round the game is fine-tuned. Also the game attributes are improved in style and design so that they are ready to be played by the external public.

The game versions, game attributes, the evaluation techniques, etc. presented in this chapter are briefly discussed and meant to present the process of the game design. In the next chapter the final version of the game and the game session are presented which are resulted from the work described in this chapter.
Previously in this thesis inland transportation is discussed, it is pointed out that higher levels of SSA can have a positive effect on the performances of inland transport. The game is chosen to be a key tool to increase SSA, the game should be supported by lecture, discussion and post-game evaluation. In the previous chapter the design process is presented. The game is evolved in several versions from the non-playable concept to the tool, which increases the SSA. In this chapter the final game design is presented.

As mentioned earlier, the key element of the game session is the game. In this chapter, little attention is paid to other components of the game session. Only at the beginning of the chapter the game session objective and its structure are presented. The rest of the chapter is dedicated to the game.

The discussion on the final game design is started with presenting the game objective and linking it to Shared Situational Awareness. The structure of the game session is presented, followed by a brief game description. The discussion of the game is continued by listing the game elements and explaining their purpose in the game. This is followed by a description of the players and the game master. Further in this section the events which can be thrown by the game master are presented and the link between certain actions and level of SSA is given. The chapter is closed by presenting the possible game strategies and the used methods to evaluate SSA during the game.

### 6.1 Game Objective and SSA

The global objective of this thesis is to increase Shared Situational Awareness, which is translated to the game objective: to show the difference between not communicating and communicating with respect to the game performances of the individual players. This objective is translated to the game, where the players can feel the positive effect of increase in SSA awareness. This effect is modeled by letting players experience the current situation in the chain, where the lack of SSA results in decreased performances of the players. This is done by isolating players from each other and by not allowing communication. After that the players are allowed to monitor each others activities and to communicate with each other. It is assumed that this results in higher levels of SSA, what directly translates to better game performances of the players. To increase the effect, the game is supported by lecture, discussion and debriefing.

### 6.2 Game Session

The game is played with three players plus a game master. The role of the game master is to guide the learning process. The activities of the game master during the game are limited to the control of rules execution and playing the Central Bank. The game master distributes the game pieces according to the Game Master Manual between the players. The players sit around the table.
The game session consists of 5 parts: introduction, discussion, game introduction, game, and evaluation. The game session is started with a presentation on the Shared Situational awareness and Hinterland transport. Slides for this presentation can be found in Appendix C. The purpose of this presentation is to introduce the players into the topic of SSA and why it is important for hinterland container transport. After the presentation, the players have the possibility to ask questions about the concept of SSA. The next phase of the game session is introduction to the game.

The game consists of days. Each day each player has their turn. He is allowed to perform a certain number of moves in his turn. The game is played in 1 round, however during the round different stages can be distinguished:

1. Learning: the game mechanics are learned by "doing", thus several game days are played where each game element is introduced to the players by the supervision of the game master.

2. Low SSA. In this round from 5 to 10 game days are played. Each player performs his tasks. The lack of SSA is simulated by the wall, which isolates each players activities from other players. Along with all the game rules, in this round it is not allowed to communicate with each other. It is expected that the players cannot cooperate and align each others actions with each other. This leads to a decreased performance and some problems.

3. High SSA. After 5-10 days playing "Low SSA" stage, the wall between the players should be removed. At the same time the players receive hints from the game master about the problems they have encountered and possible solutions to these problems. This time the players are allowed to communicate freely with each other, they are allowed to share any resources they want and to negotiate the tariffs. During this stage the players should experience less problems and show increased game performances.

During the game, the game master notices each time an unnecessary action takes place: moving the container to general import/export stack instead of directly moving it to the dedicated stacks; taking external orders; hiring an external transport operator; failed berth request, truck waiting line, handling of the events, etc. (fully explained in the Game Master description). The players are asked to keep a track on problems they encounter. In the second stage of the game, the game master keeps track on the shared decisions taken and how it has improved the game results. If the players do not use the opportunity to communicate in the right direction, the game master can decide to give more explicit hints.

After the game, the post-game evaluation is performed. During this evaluation, the game master shares his observations of the game. Players are asked to express their opinion about the game and its impact on SSA. This is used as an input for the discussion. Compared to the pre-game discussion, players are expected to participate more actively in the post-game discussion, as they have experienced the positive effect of SSA.

### 6.3 Game Description

There are 3 players in the game: Shipping Line Agent (SLA), Transport Operator (TO) and Container Terminal (CT). Players sit around the table where the game map is placed. Players operate only on their own part of the map. The interaction between the players is regulated in the game rules. The main objective for all players is to transport the game
containers from an inland warehouse to the sea-vessels and back. The participation of all players is required to transport the containers. SLA receives orders and arranges the documentation, TO performs the physical movements of the containers from the warehouse to the container terminal, CT processes the incoming containers and loads them to the sea-vessels. All the steps the containers undergo during the game are presented in Figure 6.1. All these activities do not require high levels of SSA. However, if SSA increases, many of the problems can be solved.

The game master has a set of events which he can throw into the game. The events describe a certain unpredicted situation, which has occurred in the chain. The receiver of the event has to react to this event. In case of low SSA, events are handled as required by the game rules, however if SSA increases, players can predict the consequences of this event on all players and act accordingly.

Figure 6.1: Activity flow for Export and Import Containers.
Besides, each player has activities that can be performed without involving other players. These elements are introduced in order to distract players from the main game role. To focus the players attention on certain problems and show that these problems are important, the concept of money is introduced. Rewards or costs are linked to almost all actions in the game. The amounts are not realistic, they are chosen in order to increase the educational effect of the game. Each player receives the game elements needed for him to play the game. Further in this chapter, the roles of the players are described. The full game description where all game elements such as game elements, game mechanics, rewards and costs for game actions, exact procedures are presented in Appendix A.

6.4 Actors description

There are three players: Shipping Line Agent, Transport Operator, and Container Terminal. These three parties represent a chain of partners with a long history, they all trust each other and the risks are minimal. Each actor has the number of everyday actions, which he performs on a daily basis, also there are additional activities which should be performed in certain situation. Almost each action costs money or can generate money for the actor. In the description of the actors, the money flow associated with the actors actions is mentioned. The level of SSA in the chain is linked to the accumulated money of the players.

6.4.1 Shipping Line Agent

Shipping Line Agent (SLA) is an owner of sea-vessels. SLA performs the organization of the hinterland transport and the arrival of the sea-vessels to the terminal. SLA has three sea-vessels named Drenthe, Limburg and Brabant. In this game, the Shipping Line Agent is responsible for processing new orders, arranging the required documentation, giving the transport order for inland transportation and submitting the load and discharge lists to the Container Terminal for incoming sea-vessels.

SLA takes orders from the stack of order cards. A player can choose to first arrange the documents or directly give the transport order to the Transport operator. Each order requires documentation. Export order requires PickUp release and Customs release. The former is required to pick up the goods from the warehouse. The Customs Release is required to enter Container Terminal. For the Import Container the Customs release must be granted, without which the container cannot be transported away from the terminal. The releases simulate the dependability of the transportation chain from external factors such as clients and customs: the warehouse often releases containers only when the client has paid for the goods, the customs releases containers based on their internal risk analysis. The chance that the documentation can be obtained right away depends on the end customer of the transport orders. The chance that the good client paid the warehouse and does not arise the interests of customs is very small, and very high for the bad customers. As these processes are outside of the SLA competence they are assumed to be random and simulated by throwing dice, with different probabilities for different client types. SLA does not have access to the types of clients.

SLA pays for hiring transport to TO and for (un-)loading the containers to the CT. When an order is fully executed, SLA receives the money from his virtual customer. Paying for the costs upfront and receiving the money afterwards excludes the possibility to take all the orders at the same time and give them to the external transport operators right away without including the rest of the players. SLA as an organizer is responsible for the speed
of order execution, what is translated into the following rules: each day the order spends in
the game, SLA must pay a fee; if the order is transported from warehouse to the container
terminal within 2 days (instead of the normal 3 days) SLA receives a bonus. If the transport
unit arrives to pick up a certain container, but the needed release to pick up the container
is missing, SLA pays a fine to TO.

Besides TO, inland transportation can be performed by the external operator, which costs
more money, however the transportation time is fixed to 4 days. This external transport
operator represents the transport companies with whom there are no close relations. A
higher price can be associated with the lack of trust between parties. The latter option is
to give SLA the possibility to transport the containers without involving TO.

6.4.2 Transport Operator

Transport Operator is responsible for the inland transportation of the containers between
Container Terminal and inland warehouse. He receives the orders from the Shipping Line
Agent to transport the containers between Warehouse and Container Terminal, for which
SLA pays money to TO according to the tariffs.

TO has two barges and two trucks for the transportation of the containers. In reality
the truck and barge operators are different parties, however due to the similarities in the
problems they experience, they are combined into one player. The capacity of each transport
unit is one container. In reality the barges have a much greater capacity compared to the
cars, however, the capacity does play a role for the SSA and only increases the complexity
of the game. The barges and trucks use different paths to reach the Container Terminal,
however it takes for both the same amount of days. The reason for the same speed for both
trucks and barges is based on the same idea as the same capacity: slightly decreasing the
realism of the game results in a much more playable game. The TO chooses by himself
which transport unit to use to transport a certain order. There are exploitation costs linked
to each unit, which are paid for each game day regardless whether the unit is loaded or not.
These costs symbolize the fixed costs of the trucking company.

In case there are no orders from SLA, TO can take the orders from the external parties,
which require a transportation between the warehouse to Container Terminal 2. Container
terminal 2 is chosen in order to separate the activities associated with an external order to
only TO and do not let the external containers interfere with the orders given by SLA. The
presence of the external orders for TO is based on the idea that transport operators do not
wait for the orders from their regular clients if there is a chance to take some other order.
However, as these external parties are not regular customers of TO, there are risks attached,
which lead to the smaller financial benefits.

The distance between the warehouse and Container Terminal is equal to three days,
however, the truck can accelerate and save one day by paying additional costs for the speed.
Prior to the arrival of the transport unit to the container terminal, Transport Operator
has to submit loading and discharge lists to the Container Terminal, to let CT know which
containers has to be prepared for the transportation. In reality, barges visit multiple ter-
minals during one port call, in the designed game each barge visits terminal played by CT
and 4 virtual terminals. The berth time for visiting CT has to be negotiated with CT, the
visiting time for other terminals is passively simulated by use of the cards. If berth time is
not found, the barge cannot visit Container Terminal and has to unload the containers at
Container Terminal 2, what brings additional costs for unloading the container at external
terminal, storing it there and transporting to Container Terminal.
At real container terminal the waiting line at the gate for the trucks is caused by two factors: the number of incoming trucks and the number of equipment working on the land-side of the terminal. The former is simulated by a random length of the waiting line, the latter - by giving the control of the truck movements in the waiting line to CT. If the waiting line for a certain day is too long and for the next day (in case if known) is much shorter, TO can use this truck to execute some orders, which compensate the costs associated with the truck for a day. It is also possible to hire extra trucks for one trip if needed.

6.4.3 Container Terminal

Container Terminal is a transition point from hinterland transport to the sea transport. The main responsibility of Container Terminal are (un-)loading of the sea-vessels, temporary storing the containers in the yard, and (un-)loading the inland transport units.

CT has two main berths: berth for the sea-vessels, which are operated by Shipping Line Agent, and berth for the Other sea-vessels. Separate berths are chosen to prevent the different activities of CT from interfering. Each sea-vessel of the SLA has its own dedicated part-berth. This division between the SLA berth for the different sea-vessels is a result of copying land-side problems to the sea-side: as for import container next transportation mode must be known before it can be loaded on it, for the export containers the sea-vessel name should be known too. This choice is made to exaggerate the problem of inefficient container stacking for the terminals. In reality this problem should not be occurring, the container terminals often do not accept the export containers without the information about the sea-vessels.

Terminal yard consists of several stacks: Dedicated Truck/Barge Export/Import Stack (Land Stack), Export Stack 1 and 2, Dedicated Berth Stack Drenthe/Limburg/Brabant (Sea Stack), General Import Stack, Repair Stack. The inland transport unit prior to the arrival to the terminal registers its visit by providing information concerning the containers on board and containers that need to be loaded. For trucks, CT announces the waiting time for the current day. CT has possibilities to predict the waiting line for coming two days. The moves of CT in the line are performed by the Container terminal.

Container terminal is visited by many barges each day, while the barge berth is limited. Prior to visit, a barge has to request the berth time, and in case if the requested time-slot is free, the barge can visit TO. When the berth request is made by TO, CT throws dice, the thrown number shows the number of incoming passively played barges on the current day. CT pulls this number of cards from the berth time request stack, on each card there is a time-slot at which the passive barge visits the terminal. If the requested berth time does not overlap with visits of passive barges, barge of TO can visit the terminal.

The Export container is allowed to be unloaded to the terminal only if the customs release is present. The Import container is loaded to the barge/truck only if there is a customs release and Shipping Line Release is present. The loading and offloading of the containers to/from the sea-vessels is only possible if the container is mentioned in the load/discharge list.

Each move of the game container costs money for CT. CT also pays for each day the game container is at the terminal. These costs simulate the fixed costs of the terminals. To simulate the limited resources CT has a limited number of actions for each day, which he spends on every activity he performs in the game. The lack of the resources can be compensated by hiring extra resources.

The container offloaded from the inland transport unit is stacked to the Dedicated Land
Stack. After that, it is moved to the Export Stack 1. If the corresponding sea-vessel is known, the container is moved to the dedicated Sea Stack. When Sea-vessel arrives, it is loaded to it. For the import containers the reverse flow holds. Container Terminal receives money from SLA by (un-)loading the sea-vessel. It is allowed to directly move the containers between Dedicated Sea Stack and the Dedicated Land Stack if the next transportation mode is known (for export: name of the ship; for import: next transportation mode). Thus, in the game moving the container to Export or Import Stack is not desired as the costs associated with these moves can be avoided. This simulates inefficient stacking due to lack of information about the containers. In reality this problem concerns only the import container, as export containers often cannot enter the terminal if the name of the sea-vessel is not known. However, to increase the learning effect it is chosen to implement this problem for both export and import containers. It is also possible to move the container directly from the sea-vessel to the transport unit, but it is associated with extra high costs, what can be seen as a disturbed handling processes at the terminal.

Container Terminal is visited not only by sea-vessels owned by the Shipping Line, there is another sea-vessel which visits the terminal. This sea-vessel visits the terminal, after it is fully loaded it leaves and the next day it visits Container Terminal again. Container Terminal has to load it with 15 containers from the Export Stack 2. If 15 containers are loaded within 2 days, CT receives a bonus, which simulates the customer satisfaction for fast processing time of the sea-vessel. However, each load costs Container Terminal an action, meaning that Container Terminal has to choose between: moving the truck in the waiting line, moving the game containers between different stacks and receiving the bonus for fast loading of the containers.

Container Terminal is a big party in the container transportation and it has an access to the information about end customers, where the payments and Customs history is depicted. This information is needed for SLA to pick only orders from the good customers.

6.5 Game master

Game master is not an active player in the game. His main role is to maximize the learning effect of the game. In each phase of the game session, the game master has a number of tasks. In this section the place of Game Master in the game is presented, the detailed description of his activities are presented in the Game Master Manual which can be found in the Appendix A.

The first objective of the game master is to study the topics that are covered by the introduction presentation: basics of the Shared Situational Awareness, hinterland transport structure, problems of hinterland transport (all of it is covered in the previous chapters of this thesis). Besides, the game master must know all the game rules and aspects, which can be learned from the game manual. The next task of the Game master is to prepare the game session.

During the game session, the game master seats the players around the table as presented in the Appendix B. He gives the presentation on the Shared Situational Awareness and Hinterland Transport. When all questions concerning the presented topics are answered, the game is presented. Game master asks each player to share the expectations about the game, and if some of them are far from the reality, the game master must explain unclear things. Before the game starts, the game master distributes game manuals between players.

During the game the game master has an extensive range of tasks.
• Controlling the execution of the game rules, collecting money from the players and giving the rewards.

• Filling in the information about the orders into the registration system, and in case if players have questions about it, answering questions.

• Throwing the events at the right moment and monitoring whether the players handle the events properly and registering it in the Events table of Game master scoring sheet.

• Counting the unneeded actions which lead to extra costs for the players

• Registering all the Shared decisions of the players and their consequences by filling in SSA decisions table of the Game Master Scoring System sheets

• Giving hints if needed to guarantee that the players are aware of the possible solutions to their problems.

After the game, the Game master shares his observations with the players. Also the players are asked to express their opinion about the game and the effect of the game on SSA. This is used as a starting point for the discussion.

6.6 Events

A number of events are present in the game. The events are thrown by the game master. Game master decides himself when and which event to throw, however, certain conditions have to be fulfilled. The idea of the events is to evaluate the level of the awareness of the players by monitoring the actions taken by the players to handle the event. There are two possible ways to handle the event: as required (thus following the rules of the game), or as desired (performing actions which are not required but can influence in positive way other players). Further, these events are described.

1. Broken Container. Broken container (or leaking, smoking, etc.) is found on the barge, TO receives the notification. According to the rules TO has to inform SLA about that. However, this information is needed for the terminal in order to put the container immediately into the repair shop. Otherwise the container is moved to regular stack and only transported to the repair shop if the end client gives the order to do so. To exaggerate if CT is not informed about it, the broken container causes the collapse of the stack, when it reaches the terminal, what causes high expenses to the CT.

2. Broken Truck. It can happen that the truck breaks down, meaning that the loaded container will be late at CT. Transport operator needs to handle this event by himself by hiring an extra truck to transport the container. However, the costs for hiring an extra truck are much higher than the costs for SLA for extra two days. Instead of hiring an extra truck, TO could agree to compensate the additional costs for SLA.

3. Broken Warehouse. The main gate of the warehouse cannot serve transport units for coming two days, instead the transport units need to use the secondary gate. SLA does not have to do anything, however units coming to warehouse need to wait two days or to take a detour to get to secondary gate. Both cause losses to TO, however if SLA informs TO immediately, the transport units could go directly to secondary gate, saving money for TO.
4. Rush Order. There is a rush order on the sea-vessel which has just arrived to CT. SLA has to arrange the transportation within the same day. Both TO and CT are not keen to help SLA in this job, because for both it means extra costs (disturbing the terminal processes for CT and hiring extra capacity for TO). However, the reward for SLA is much higher for this event than expenses of TO and CT.

5. Broken Terminal Crane. Crane Serving trucks is broken for two days. CT is not required to inform anybody but no truck can be served and the waiting line does not reduce. If TO is informed about this event, the trucks could be put on other jobs saving TO money for truck exploitation, also SLA could adjust their order taking activities.

Thus, for each event high levels of SSA result in better event handling. To show the difference between high and low level of SSA, several events are thrown during the first days of the game when players do not see each others activities and communication is not allowed. In the second phase, when the wall is removed and the communication is started, other events are thrown.

6.7 Actions influenced by SSA level

The game is designed in such a way that players can operate without communicating with each other. However, this behavior leads to certain actions that are redundant, undesired or a more efficient/effective alternative exists. In case if the players communicate they can come up with the solution to these problems. In this section, the Actions influenced by SSA level are presented:

1. Waiting in the line at the Gate. The time that truck spends in the waiting line can be considered a waste of time for Transport Operator. In the game each day of each unit costs money to Transport Operator. CT is not keen to spend his actions on the trucks, because it does not bring him money, it only decreases the chance to get a bonus for fast loading other sea-vessels. However, the costs of waiting are much higher than the costs for buying extra actions for CT. Also CT knows the waiting line for the next two days. If for one day it is significantly shorter than for a current day, TO can put his truck for one day on another job.

2. Not found barge berth time. In case if a barge cannot berth at Container Terminal, containers loaded on barge have to be unloaded at Container Terminal 2 and the transportation to Container Terminal 1 has to be arranged. At the same time, the import containers at Container Terminal stay at terminal till the next transport unit arrival. Time and money lost due to not-found berth time are wastage. However, according to initial game rules, for berth time request TO has to pick one time-slot not occupied by other terminals and check with CT whether it is free or not, if not the berth time is not found. Instead, TO operator can check whether other slots are free or not, in such case the passive barge visiting CT also give all free time-slots they have. This increases the chance to find a time slot suitable for both TO and CT.

3. Hiring external transport/taking external orders. The organizing parties in the chain often work with known and trusted carriers. Hiring external transport operators for SLA as taking orders from external parties for TO can lead to unnecessary risks and higher rates, what translates to losses. Thus, external cooperation between SLA and TO, alignment of their planning can result in a more efficient transport.
4. Stacking the containers in the General Import/Export Stack. Each container move at the terminal costs money to the terminal. Unnecessary moves from one stack to other stacks, shuffling moves, etc. have to be minimized. In the game, it is possible to move the containers directly from land-dedicated stack to the sea-dedicated stacks, however, only if the next transportation mode is known. This information can be provided by TO or by SLA, however, they are not aware that this information can be useful to CT.

5. Handling the event in an improper way. In case if the event is handled not properly, one of the party can experience losses. In the game, the event can be handled properly, what minimizes the costs for the player.

6. Not hiring an extra truck. The costs for an extra truck are slightly higher for TO than the reward from SLA for transport. However, the prices could be negotiated, so that it is desired for both SLA and TO to hire extra trucks, but without communication it is not possible.

7. Not taking a fast route for trucks. The costs for taking a fast route are on TO, however if the truck moves faster, SLA receives a bonus, which is higher than the truck costs. Communication between actors could lead to a bonus-sharing agreement.

Each time one of these actions is executed, the game master has to notice it in the scoring sheet in order to bring this up during game evaluation. If the players increase their level of Shared Situational Awareness, the effects of these actions can be switched from negative to positive. It should be noted that while the game problems are derived from real problems, the solutions to these problems, which can be found in the game, can be impossible in reality. The objective of the game is to show that higher levels of SSA lead to the solutions of the problems and not to resolve the problems.

6.8 Game Strategy

During the first game days, players only learn how to play. Thus, it is not expected that the players show any strategic behavior during these days. After several game days players start maximizing their rewards and minimizing their loses. Due to the wall and the lack of communication it is expected that SLA often gives orders to external transport operators, TO often takes orders from external parties, CT concentrates his attention on loading Other sea-vessels within 2 days for the bonus. In the second phase of the game the players are able to see each others problems and communicate with each other. It is expected that this change in the rules translates to the change in the players behavior: the external parties are less often involved in the game; many problems are solved by communication; prices are negotiated; the events are handled properly.

6.9 Evaluating Shared Situational Awareness

To evaluate the Shared Situational Awareness the combination of three methods is used: observer-rating, performance evaluating and self-rating. The game master is responsible for the evaluation of the game session results.

The first method implies observing the players behavior during the game and evaluating it. To support this, the game master is provided with the Scoring Sheet where the aspects required to be monitored during the game are presented. At the end of the game, Game
Master compares the results for the first phase of the game with the wall and with the results from the second phase.

The second method is based on counting the money of the players. Lack of SSA results in more losses for the players. The second phase of the game leads to better financial results for the players.

The third method implies using the expertise and experience of the players in the field. During the evaluation phase of the game session, players are asked to share their opinion about the game and which effect it has on the level of Shared Situational Awareness.

The opinion of the players together with the results from the two first methods are used as a starting point for the discussion.

6.10 Sub-conclusion

In this chapter the final game design is presented. The game is capable to increase the SSA is presented. The game is a part of the game session: lecture, discussion, game and evaluation. The whole process is supervised by the game master, who has a number of tasks before, during and after the session.

The lecture is given on topics of SSA, inland transport, and the game. The objective of the lecture is to introduce the players into the subject of the Shared Situational Awareness, show why it is important in inland transportation to have SSA and how the game can increase it. After the lecture the small discussion is held to answer the questions. After the game is introduced players start playing.

The game has three actors: Transport Operator, Container Terminal, and Shipping Line Agent. Their main objective is to execute the transport orders, each having its own responsibilities. All the game activities can be performed having very low SSA, however as SSA increases the game performances of the players increase. For this reason, the game is played in two phases: low and high level SSA. In the first one it is not allowed for players to communicate with each other and each others activities are hidden due to the wall, in the second phase the wall is removed and it is allowed and also stimulated by the game master to communicate. It is expected that due to the allowed communication, players SSA increases, which leads to higher game results. The problems embedded in the game are derived from reality, however, the solutions to these problems which can be reached with higher levels of SSA, can be impossible for reality, the games objective is to show the effect of the SSA and not to come up with the solutions. After the game the game results are discussed.

The game master is responsible for the organization of the game session. He gives a lecture and leads the discussions. During the game, the task of the game master is to control the execution of the rules, to notice the important game events and to evaluate the SSA of the players.

The game developed in this chapter has been tested during the design phase described in the previous chapter. The next step is to perform the final game session, based on which the game is evaluated on all aspects. All the procedures for the final tryout are described in following chapter.
Designed game session described in previous chapter has a main objective to increase Shared Situational Awareness in hinterland container transport at port of Rotterdam. The key element in the session is the game, while the lecture, discussion and evaluation support the game. In the designing phase the game is played several times as described in Chapter 5. During these tryouts game was evaluated on all three dimensions: playability, meaning and realism. However, players engaged in tryouts were different from the target group of the game. Thus, no conclusions could be derived about the effect of the game on the target group. To evaluate the final game design additional tryout is performed with the representatives of the industry.

In this chapter the evaluation of the game is performed based on the final tryout. First the tryout is described by presenting the experimental setup, the process of the game and the game results. Based on obtained results the game and the whole game session is evaluated in the second part of this chapter by evaluating the game on all three dimensions: reality, meaning and playability. At the end the game is checked whether it satisfies the requirements posed in Section 5.4. The chapter is closed with final evaluation of the whole game session.

### 7.1 Final Game Tryout

Number of tryouts are performed during the design phase of the game. The objective of these tryout was to test the certain game version whether it satisfies the game objectives. These tryouts were performed with the players, who are not involved in container transportation. The consequences of this composition of the tryouts is that it is not possible to derive the conclusions whether the game reaches the posed objectives or not. As a last step in designing the game the tryout was held with the representatives of the target group. This tryout was used in order to evaluate the potential of the game session as a tool to increase SSA and to identify the most appropriate place to apply the designed game.

Further in this section the final tryout is described. The game session is briefly described from the start till the end, the comments of the players and observers are also mentioned. After that game results such as decisions taken by the players, money spent on certain activity, etc. are presented and discussed, that is followed by the analysis of the SSA of the players.

#### 7.1.1 Game session process

The objective of the last tryout is to evaluate the game session and game in particular whether it reaches the objective. The session was held at RDM campus on 17th October. It took approximately 3 hours from the beginning till the end. The table was prepared according to the game manual, all the game pieces were distributed upfront and the wall was placed between the players. The room did not have the projector to show the sheets prepared for the presentation. The players invited for the game session represent following actors in the hinterland transport: container terminal, transport company and forwarder.
The role of the game master was played by the designer of the game. The participants were excited about the game. However, they did not have a clear idea about the purpose of the game.

The session was started with a brief lecture on topics of SSA, SSA in hinterland transport and the game as a tool to increase SSA. As there were no questions about the content of the lecture, the discussion part of the session was skipped.

Next step in the game session is a game itself. The game roles were assigned according to players field of expertise, game master presented each role to the players. The general idea of the game was explained and the game pieces relevant for all players, such as containers, order cards, etc. were presented. The rest of the game mechanics were presented during the first game days, where game day is defined as a round of a game. The game is supposed to be played in parallel but at the beginning of the game players play sequential to learn the game mechanics. During these days, the players performed their daily routine under supervision of the game master. After 3 game days, when all game mechanism were played for several times and the players showed the understanding of the game, players executed their daily activities in parallel. At this point the focus of the game master was switched from explaining how the game is played to observing the game process. On game day 5 the “broken container” event was thrown into the game.

After around 10 game days, the game was paused to remove the wall and to explain new rules concerning the communications and possibility and to negotiate prices. New berth time cards were distributed and new mechanism was explained. On game day 14 the rush order event was thrown. Players played about 10 days with new rules and the game was stopped. After that the game results and the game itself were discussed. During this discussion the difference between Low and High phases is pointed out to the players. The players were asked to share their experience with the game and how the game can effect the level of SSA. The evaluation phase of the game session transformed into the discussion on the possibilities for improvements for the chain.

7.1.2 Game observations

Game was played till the end, no major disruptions happened during the game process. At the end of the game the players significantly increased the amount of money which was given to them. The results of the game process should be divided into three phases: learning, low SSA, and high SSA.

During the first game days players were learning how to play the game. At this phase a lot of questions were asked concerning the game mechanics: how to take an order, how to get an order, how to get a berth time, how to move the container, etc. During the first game day money was not collected for most of the activities to prevent the players from information overload. On the second day the players were asked to pay money according to the game rules. The reason for paying for certain things was not clear at first for the players, after the explanation of the game master, players understood the underlying idea. During the third game day players did not have a lot of questions, and due to sequentially of the game process players who were waiting for their turn, became bored. At this point it was concluded that the players learned the game to satisfactory level and the game process was switched to the parallel mode.

Since day 4 the players behavior was observed. It should be emphasized that between the game days 4 and day 10, players did not have possibility to see each others actions and it was not allowed to communicate, this phase can be called low SSA. During this phase Shipping
Line Agent (SLA) was taking too many orders, and as the required release was obtained SLA gave orders to TO. The amount of given orders to TO exceeded the number of transport units TO had, it resulted in high costs for SLA as the orders transportation speed was linked to the money. TO did not take external orders for transportation, meaning that TO did not lose money by taking external orders. However, Trucks of TO were spending several days in waiting line for as CT’s focus was on loading the Other sea-vessels. Unexpectedly, requesting berth time for barges did not cause any problems, each time barge was visiting the terminal TO guessed the free time slot. CT was losing Actions and money on moving the containers to General Stacks and on the number days containers stayed within terminal. The former was caused by both TO and SLA as they did not timely provide information about next transportation mode to CT. The latter primarily concerned import containers and caused by SLA, as TO could not keep up with the incoming number of import orders. SLA did not have intention to give orders to an external operator.

When the ”Broken Container” event was thrown TO had informed Shipping Line Agent about this event. However, no further communication took place, and as container reached terminal and had been put into stack CT received a message that broken container had caused collapsing of the stack and caused a lot of financial consequences for CT. As this container was put out of the game, SLA did not receive its money for the transportation.

The third phase High SSA differed significantly in the process compared to the Low SSA phase. The possibility to see each others actions and to communicate engaged players to negotiate almost each step they made. This enabled both more aligned processes in the chain and usage of game features which were not available without the communication, such as costs/benefits sharing. SLA discovered that one of the bonus could be easily received if TO was compensated for extra made costs. The same held for hiring extra trucks for TO if SLA needed fast transportation. All visiting barges could obtain the berth time, however, players experienced less stress as the changed procedures concerning the berth time request had higher chance of obtaining the berth time. At the same time trucks were spending less time in the waiting line at Gate of terminal as the CT was agreed to buy extra actions for land-side operations in exchange for compensation. Both TO and SLA provided CT with information about next transportation mode for the containers, what resulted in less container moves at the terminal, which saved money for CT and more actions could be spent on serving SLA and TO orders. Rush order event thrown during this phase was executed as desired: both CT and TO agreed to perform rush activities to serve this order. The extra costs were compensated from the bonus which SLA received.

7.1.3 Final Tryout Evaluation

In previous section the final game session tryout is discussed and the game results are presented. In this section the evaluation of the game session is presented.

The introduction lecture attracted attention of the players, however, due to its briefness only the general aspects of the problem are touched. Players had not linked the presenting topic to their activities, so the interest in the lecture was decreased and, as a result, the absence of questions during the discussion round. Hence, more interesting lecture should be given, for which pre-study about the backgrounds of the players is performed in order to adjust the presentation to the participants. Also after players agreed to participate in the game session they can be asked to prepare the list of the problems they experience which are caused by other parties. These list can be used during the pre-game discussion and post-game evaluation.
The first days of the game, the players had a lot of questions concerning the game mechanics, constant help from the game leader was required. The game learning process is complicated due to the number of the features embedded in the game. While many game processes could only be learned by doing (for example getting berth time for barges), several questions concerned game mechanics which game designers regard as simple and intuitive (such as number of steps one transport unit can move each day). These basics game mechanics should be included in the game role description which should be distributed before the game start so that no time is wasted during the beginning of the game on these trivial questions. The game role description has to be short and only the simple game mechanics should be included, the rest should be explained during the first days of the game.

During the Low SSA phase, one problem was discovered in the process of the proposed game interaction: the SLA had no possibility to know when the export container reaches CT, TO did not know when the import container is free to transport. During the game, the solution was proposed, which is incorporated into the game manual.

In Section 3.6 appropriate techniques to measure SSA are identified and in Section 6.9 the use of this techniques for the evaluation of SSA is described. According to the first techniques, observer-rating, in the High SSA phase players show higher levels of SSA as they solved many problems which required a collaborative decisions. These actions translated to the higher performances of the players: their costs dropped while the revenues increased. According to the second evaluation technique, performance measures, SSA is also increased.

The third techniques is self-rating, which implies using the expertise of the players. The players agreed that this game can be used as a tool to increase SSA of the new employees in the companies involved in container transportation or as a part of educational process in the logistic studies. According to the players this game demonstrates the consequences of each others actions, the costs associated with decisions/actions for involved parties. The removal of the walls provided the players with the insights about the reasons for the certain events: why it takes so long, why it is not done yet, etc. The players agreed that more awareness about each others activities leads to more alignment in the chain processes, less problems, etc. From game master perspectives it can be concluded that this game provided players with insights to each others activities, presented some problems from the real life discovered during the project and showed the positive effect of SSA. Due to the players high level of experience in their fields, the effect of the game session was not significant on these three particular players.

Players gave also the feedback about the game itself. In general the game design was evaluated as "not bad", "playable", however certain aspects caused critics. The players noticed that learning how to play the game takes a lot of time. The alternatives for the controlling the execution of the game rules should be found, as the game master cannot always follow everything what players do. During the game 2 events were thrown, players proposed to throw more events during the game. Game master has a choice of 5 events, thus instead of throwing only 2, all five can be thrown during the game, this proposal is processed in the game manual for the game master. The absence of difference between the truck and barge brought most of critics. The choice to equal the barge and trucks was not initial desire of the designers, however, test tryouts showed that realistic difference in the capacity and transportation speed result in the higher game complexity, what does not contribute to the learning objectives of the game. Players proposed to put on the containers various restrictions concerning the number of days that the container can spent at the terminal or how many days the transportation can take. This would increase the complexity of the game, in the present version of the game it would be
extremely difficult to trace it. Instead the registration of the container could be performed on the computer, but it lies outside the scope of this project, so these proposals are not included in the game design. TO could only hire one extra truck, player proposed to increase this number. Also Container Terminal player experienced a low workload compared to the other players. The last two comments are processed in the game manual: the number of available actions for CT per day is decreased and TO can hire multiple trucks.

In this section the final tryout is described. The feedback given by players is evaluated and in some cases it has led to adjustments of the game. Due to the high experience of the players in their working fields, the effect of the game session on their SSA was not significant. However, based on players feedback and the observations of the game master game session was concluded to be successful: the potential of the game to increase SSA of the actors involved in transportation is revealed, the feedback was gathered, the possible application fields are discovered. Based on the results presented in this section, the final evaluation of the game session is provided in the next section.

### 7.2 Game Evaluation

In previous section the final tryout is described. According to Reality Levels of (Kriz, 2003) depicted in Figure 7.1 the game is built and played (Levels 2 and 3), which is followed by the debriefing. The objective of any learning tool is to adjust the Reality Level 1, in this case, to increase SSA level in hinterland transport. In this section, the effect of the game session on the hinterland transport is evaluated.

![Reality Levels](image)

Figure 7.1: Reality levels (Adopted from (Kriz, 2003)).
The game has three main dimensions: Reality (the link between the game world and the real world), Meaning (the potential to increase the SSA) and Playability (the attractiveness of the game from players perspectives). The scores on each dimensions are discussed in this section. During the first stages of the game design requirements are posed on the game, and it is crucial to check whether the final design fulfills these requirements. Further in this section the game is evaluated on these criteria and final conclusion about the game is derived.

7.2.1 Reality

In Section 5.2 the discussion is given how the reality is translated to the model of the reality, also the elements of the reality which must be present in the game are presented. In this section the reverse work is described: the designed game is evaluated on how the game reflects the reality.

In the game there are only three players, some actors from the reality are played passively by means of the "external order" cards, throwing the dices for the customs release, etc. The rest of the world is not included in the game. Money are included in the game to increase playability and learning objectives, they increase the involvement of the players into the game and the same time are used to show that the wrong actions result in more losses. The tariffs, rewards and fines are chosen randomly and fine-tuned to increase playability. Further, each actor is discussed and then certain game elements receive the attention.

**Shipping Line Agent.** The initial idea about the player which is responsible for the organization of the transport concerned only the forwarders activity. The tryouts showed that such approach is not desired from the perspectives of the playability due to unequal game load. For seeking of equal game load, the forwarder is renamed in Shipping Line Agent, and his responsibilities are extended with three sea-vessels. The process of receiving the orders by simply taking the card with no limitations is highly simplified, however, it is satisfactory enough for this game due to the focus on the SSA rather then on how the SLA receives his orders.

Shipping Line, customs and pickup releases are real issues in the world of transportation, and as in the game, the outcomes of arranging the release depend on the end customer behavior, their status, the previous ports of calls, routes of the vessels, etc. and can be seen as nondeterministic for the organizers. Thus, the mechanism of throwing dices to determine the results of arranging the documents, can be seen as realistic, however the chances of getting the positive results are chosen from the perspectives of the playability. The element of dependency of the chances on the status of the end a client (good or bad) is added from the learning perspectives. The process of giving the order to Transport Operator or to the external operator represents the reality.

**Transport Operator.** Transport Operator has barges and trucks. This mix is not realistic, most of the inland carriers have a focus either on the barges or on the trucks. Despite of different nature of activities of the truck and barge operators, the interviews showed that from the perspectives of this project, they can be seen as one party. Thus, the combination of the activities of both truck and barge operators in one player does not harm the reality factor of the game. But it increases the learning objective by combining the problems of the inland carriers in one player.

The process of receiving the orders is similar to how it is done in reality, however, in
the game no attention has been given to the planning of the capacity. The speed and capacity of the barge and trucks are the same. This contradiction to the reality is chosen deliberately to decrease the complexity of the game: the tryouts of the first version of the game showed that game with such high level of the reality are not playable. The possibility for Transport Operator to take an order from an external parties is realistic.

**Container Terminal.** The main objective of Container Terminal is to process the incoming sea-vessels, in the game it is realized by one sea-vessel which constantly visits Container Terminal and three sea-vessels from SLA. This main objective requires processing the containers from the inland, stacking them and pushing to the sea-vessel berth and other way around. These activities are simplified: passive sea-vessel is only loaded with the containers from Export Stack 2, the containers for SLA sea-vessels undergo all steps at Container Terminal and no other containers are present. During the game design it is concluded that these activities of Container Terminal represent a healthy mix between the reality and playability. Container Terminal has limited equipment and to recreate this aspect the number of actions per day is limited for the Container Terminal. Due to this limitation player is forced to set priorities.

Container Terminal is visited by many trucks and barges each day, however, in the game there is only one transport operator. The rest of the inland transport units is passively simulated during the registration of the visits of the barges and trucks. The number of the incoming barges and trucks is not fixed, the throwing dices for the barges and pulling the cards are chosen as appropriate methods to simulate this number. The procedure of requesting the berth time is similar to how it happens in reality, but it is realized in an extreme way in order to let the players feel the problem, thus this realism is decreased to increase the learning objective. The waiting lines for the trucks are less attached to the reality, however, as in the real situation, the waiting time depends on the number of the incoming trucks and the number of the equipment units on the sea-side of Container Terminal. As in case of berth time request, the waiting time is extreme: the trucks does not spend days in the line, but this is done to increase the learning objective.

**Events.** The events are meant to evaluate the level of the SSA of the players. Several of the events are derived from the performed interviews, the rest are added to the game to balance the payload, and chosen in such way that they do not contradict the reality. The purpose of the events is to evaluate the players SSA.

**SSA Decisions.** The communication in High SSA phase should lead to the better performances of the chain in general and each actors separately. This requires from actors to take certain decisions collaboratively and cooperatively. The game has a certain number of embedded decisions that players can make. These decisions does not represent the solution to the real life problems, only the problems in the game and meant only for the purpose of increasing the SSA.

**Conclusion about the reality of the game.** To sum up, the game is based on reality. At the same time, many elements of the reality are simplified and modified to balance between three dimensions of the game: Playability, Meaning and Reality.
7.2.2 Playability

The game is concluded to be playable based on the internal game tryouts and final tryout. The players experience is different in each game phase.

To analyze the players experience Figure 3.9 from Section 3.5.3 is repeated in Figure 7.2. At the beginning of a game players skills are low and due to initial complexity of the game the players come directly at the start of the game into Anxiety state, when everything seems too difficult for them. However, during the first game days, players receive extensive help from the game master, thus the skills are rising. At certain point money concept is fully introduced to the game what increased the game complexity. By playing additional day the players come into the Flow state, when their Skills level is adequate to the Challenge level (or complexity of the game). When the game master feels that players have reached the required skills to play the game in parallel, the learning period ends. It should be noticed that the switch to the parallel process should not be done too early, to prevent the players entering Anxiety mode again. The thrown events cause the instant rise in complexity.

The players skills continue to rise, before the players leaves the Flow and enters the Boredom state game master removes the wall and allows communication, increasing the complexity of the game. After this point the challenge increases as players make new agreements between each others. The game stops when the game master notices that the players have gained enough skills and started to become bored.

This analysis of the game process corresponds to the observations and feedback from the tryouts. Only during the first days the players experience is outside the Flow state, what is acceptable as Serious Games imply the certain level of complexity. After the Flow State is reached, the players show the interest in the game, the possibility of negotiations in the High SSA phase of the game stimulates the interests for the game dynamics. Crucial element for the playability is money as it increases the involvement of the players into the game processes. The players of the final tryout commented the game as ”not bad” and ”playable”.

Conclusion about the playability of the game. To sum it up, the game is not only playable but also interesting to play. Players experience the problems only at the beginning of the game due to initial complexity of the game. At the same time, many elements of the reality are simplified and and modified to balance between three dimensions of the game:
Playability, Meaning and Reality.

7.2.3 Meaning

The learning objective of the game is to show the positive effect of the High levels of SSA. During Low SSA phase, players cause a lot of inefficiencies for each other, they cannot handle the events properly and number of problems occurs. In the High SSA phase the players operate more efficiently and cause less problems to each other. The difference between the phases is significant and the experts participated in the last tryout could identify the positive consequences for their game performances of the switch from Low to High SSA. According to these experts the game can be used to give insights of the inland transportation to the new employees of the companies involved in the inland container transport and to students of the logistics studies.

To explain how the communication and removal of the wall in High SSA phases causes the increase reflects on the performances Figure 4.4 is repeated in Figure 7.3. The left part of the figure illustrates how the decisions and actions are taken based on the SSA in Low SSA phase, where the communication is not allowed. During this phase players experience the problems which are caused by other players (inefficient stacking for CT, long waiting time at the game for TO, long total transportation time of SLA). When the wall is removed and communication is allowed, many problems are solved by communicating and negotiating. The starting point of this change is the removed wall, players can see each others actions. This can be seen as an increase in SSA. Increased awareness about each other activities results in questions to each other. These questions concern the game mechanics, prices, possibility to do something extra, etc. Thus, increased awareness leads to the increase in communication between players. The questions transform into the negotiations and in many cases result into the actions. Thus, the increased communication results into higher levels of SSA, what transforms into the actions, which are more favorable for all involved parties. The process of increasing SSA and consequences for the performances of the players is similar to the explanation how the problems can be solved in hinterland transport from Section 4.8.

Recalling the theory on System Situational Awareness presented in Section 3.3, System Situational Awareness in Low SSA phase of the game corresponds to the maturity Level 1, Perception: there is a broad global goal to transport the containers. The change in rules in the High SSA phase of the game leads to the increased SSA: players start coordinating plans, monitoring each others actions and operations. According to Kurapati et al. (2012)
this can be seen as maturity Level 2, Prescription.

**Conclusion about the meaning of the game.** To sum up, game shows the positive effect of having higher levels of SSA.

### 7.2.4 Requirements

In Section 5.4 the requirements are posed on the final game design. The game analysis and the results of the final game tryout are used to check, whether the final game fulfills the requirements:

1. No special training is needed to play the game: PASS. The players are able to participate in the game session without any extra prior knowledge or training.

2. The playing time should be limited to 3 hours: PASS. The duration of the game session is between 2.5 hours and 3 hours.

3. No complicated calculations which require the use of computers are allowed to be in the game: PASS. All calculations which are required for the game involve basic arithmetic (plus, minus, multiplication) with small numbers.

4. Only one game master: PASS. One game master is able to lead the whole game session without external help.

5. The game master should not be involved in the game flow: semi PASS. Game master is not involved in the game, however he is responsible for keeping the Central bank.

6. No more than 6 players are allowed: PASS. There are 3 players in the game

7. The positive effect of higher levels of SSA should be quantitatively seen in the game results: PASS. In case of the higher SSA, players can gain higher rewards, also the operating costs decline with higher SSA.

8. The comparable activities and the results for each player: NOT PASS. Each player have its own set of the activities and they are difficult to compare with each other. The reasons for failing this requirement is that the chosen actors are involved in totally different activities in the reality. No way is found to link the activities of different actors to some comparable activity in the game.

9. It should be possible to learn how to play a game within 10 minutes: FAIL. Learning period takes about 20-30 minutes.

10. Each player has to have the same load during the game: PASS. Each player is equally involved in the game, the interrelations and interdependencies between different players pairs are balanced.

11. The aspects of the game which are associated with the Shared Situational Awareness should be easy to observe: PASS. The game master has clear instruction what and how to observe, this includes simple registering the certain game activity.

12. High levels of SSA has to be translated to the better game performance in any case: PASS. It is not possible to reach global objectives without collaboration and cooperation.
The game passed all the requirements except two: Requirement 8 and Requirement 9. The latter is not crucial and this fail is acceptable as long as the total game duration does not exceed 3 hours. The former requirement is more fundamental: the comparable activities lead to higher playability due to possible competition between the players. However, due to the large difference in the activities of the different actors in the reality it is decided that this requirement is not necessary to fulfill. Requirement 5 is only partially fulfilled and the game master is involved in certain game processes, however as it is observed during the tryouts, this involvement does not distract him from the execution of the primary responsibilities. Based on this analysis, it is decided that the game fulfills the requirements.

### 7.2.5 Final Evaluation

In Section 5.3 the objectives on the end game design are posed. The above evaluation of each component of the game shows that game design reaches all the posed objective:

- **Playability**: the game is playable and interesting to play, the game experience stays within the Flow after players have learned how to play.
- **Reality**: game is based on the model of the reality, most of the game elements are derived from the reality, the unrealistic elements are chosen deliberately to increase meaning component or to decrease the complexity of the game.
- **Meaning**: game reaches the posed objective to show the positive effect of having higher levels of SSA.

Besides reaching the proposed objectives, the analysis shows that designed game satisfies all requirements except two requirements. The failure to pass these two requirements is found to have no consequences on the final game design.

The end product of this project game session is capable to reach the objective of the game and has the desired learning effect. In terms of Reality Levels of Kriz (2003), Reality Levels 2, 3 and 4 change Reality Level 1 in the desired way. Hence, the game session, as the project itself, can be concluded as successful. This game session can be used as a learning tool for new employees of logistic companies or for students of logistics studies. It is highly unlikely that this game can be used for experienced employees as it takes about 3 hours and the effect of the game is difficult to translate to the financial results.

### 7.3 Sub-conclusion

In this chapter the game session described in previous chapter is evaluated.

The final tryout is performed with the representatives of the industry: container terminal, transport operator and forwarder. The game session consisted of lecture, game and game evaluation. Due to the absence of questions the discussion part is not been performed, and the game was played immediately after the lecture. The first game days the players had difficulties understanding the game mechanics. However, after players had learned how to play the game, they entered Flow state. The game is played in two phases Low and High SSA, each has different rules. In the second phase when the wall hiding each others activities was removed and the communication was allowed, the performances of the players increased, less problems were encountered. This change was linked to the higher levels of SSA. Thus, the
game showed the positive effect of having higher levels of SSA. During the game evaluation players shared their experience with the game and gave certain feedback. Players liked the game and expressed the opinion that this game can be used in educational process of the logistic students or new employees of companies involved in container transport. Provided feedback is partly processed in the game rules.

The results of the final game session were used to evaluate the game session in general. The game reaches the objectives of the game: it is playable, it is based on the reality and it shows the positive effect of SSA. Game also satisfies the requirements.

Based on the evaluation of the game and results from the final game tryout, this project can be concluded as successful: the game session is designed which shows the positive effect of having higher levels of SSA. This effect can be used to give a helicopter view of the processes in inland transport to the new employees and students of the logistics studies. The participation of more experienced employees is highly unlikely as it takes about 3 hours to participate in the game session, and as the increased SSA cannot be directly linked to the financial benefits.
The focus of this thesis was on the Shared Situational Awareness in the inland transport from and to port of Rotterdam. In the initial stage of the project, it has been concluded that for the gateway ports, performance of the inland transport directly influences the performance of the container terminal. The inland transport and problems associated with it have been analyzed and it has been pointed out that the Shared Situational Awareness plays a role in inland transport and container terminals and whole inland transport can profit from higher levels of SSA. This problem statement is translated to the main objective of the project:

>To design a serious game to increase the Shared Situational Awareness in inland transport from/to the port of Rotterdam.

This objective is translated into the main research question: How can SSA in PoR hinterland transport be increased by the use of a serious game. Due to the dual nature of this question the project is executed into two parallel flows: investigating SSA in inland transport and designing the game. For each flow the main research question is divided into several sub-questions.

The conclusions of the research are presented further in this chapter and followed by recommendations. The chapter is closed with the discussion of the contribution of this project to the SALOMO project.

### 8.1 Conclusion

The inter-dependencies between the topics of inland transport and game design led to the concurrent execution of the project flows. The sub-conclusions of one flow are used as an input for the other flow. The conclusions of the project are presented in the following section.

In the initial phase of the project it has been claimed that Shared Situational Awareness in inland transport can increase by playing the game. To verify this claim the literature review has been performed on the topics of Shared Situational Awareness, inland transport and serious games. The first questions that had to be answered was what the Situational Awareness is and why is it important. To address the topics of Situational Awareness, Team Situational Awareness and Situational Awareness the distributed networks were investigated. It has been concluded that Situational Awareness is crucial for the performance of the distributed systems. Thus, the inland transport, as a typical distributed system, can profit from the increased SSA. Also, the inland transport can be seen as a complex adaptive system, and it is pointed out that the knowledge about such systems and the SSA in it can be increased by means of serious games. The literature review on games revealed the position of the games in the learning process and for which purposes they are especially useful. The analysis showed that Shared Situational Awareness can be learned by playing games. However, to maximize the learning effect from the game it is decided to support the game with several tools: literature on the topics of Shared Situational Awareness, Inland
Transport and Games, pre-game discussion and post-game evaluation. Thus, the objective of this thesis is to design a game session.

In order to design a game session with the objective of increasing SSA in inland transport, the inland transport is investigated in more details. Firstly, the actors involved in container transport in general are identified. They can be classified in five groups: physical, organizing, customer, authorizing and financial groups. Physical transport and organizing groups are found to be most crucial for the inland transport as they are directly involved in the container transportation. The organizing group is an intermediate step between the inland carriers and end customers, who in general do not have any knowledge of transport. The organizing group is presented by shipping line agents, forwarders, expediters, etc. The representatives of the physical group in inland transport are: container terminal and inland carriers (barge, rail and truck operators). Barge and truck transport are responsible for 90% of the total amount of transported containers at the Port of Rotterdam. Along with the small share, the rail operators experience less problems with the lack of Shared Situational Awareness: they are relatively large parties that do not experience problems entering the container terminal, they are often served by dedicated equipment. For these reasons the rail operators are excluded from detailed investigation in this project. Hence, for the purposes of this research following actors have been identified as the most important ones: container terminals, barge operators, truck operators and organizers of the inland transport.

These parties are investigated in more details in order to understand the influence of Shared Situational Awareness in inland transport. This is done by interviewing the representatives of the industry. During this project following parties are interviewed: two barge operators, truck operator, shipping line agent and forwarder. The container terminals could not be reached. However, due to the popularity of container terminals in the literature, the outcomes of this thesis are not significantly influenced by absence of the interview data from the container terminal representatives, it has been replaced by extensive desk research on this topic. The purpose of this phase of the project is dual: to understand the procedures of the actors concerning the container transport and to discover the problems concerning the lack of Shared Situational Awareness.

The booking procedures are more or less similar for the transport operators and organizers: the possible dates and rates are discussed, if parties agreed, the order is planned into the system. The organizers book then the physical transport, the moment of booking differs: import orders for barges are booked weeks before the arrival of the sea-vessel; the import orders for trucks are mostly booked only after the containers obtain both customs and shipping Line releases, the export containers are booked not earlier than several days before the transportation day. In the physical inland transportation of the containers the terminal visit is of great interest as it causes significant difficulties to the transport operators: trucks waste hours in the waiting lines at the gate in, the barges has to request the berth time. Also, it is common for big terminals that the load and discharge lists have to be submitted before the visit. At the terminal the containers are put into stacks, for more efficient stacking, following information is required: weights, next transportation mode and pick up time. Discovered procedures are used as an input for the procedures in the game.

The interviews revealed a number of problems that can be explained by the lack of SSA. However, the actors in inland transportation often do not see certain difficulties as problems, which require attention. Thus, the discovered procedures are used to derive additional problems. The problems found during this project are:

1. Berth time request for barges.
2. Switch from one transportation mode to another for the import container.

3. Lack of some details about the container (e.g. PIN code is missing).

4. Feedback (container terminal does not give feedback about the status of the containers).

5. Waiting time for the trucks at the gate.

6. Short planning horizon of trucks due to late order (details) arrivals.

7. Payment issues between sender and receiver of the goods.

8. Customs system failure.

9. Inefficient stacking of the containers at the terminal due to absence of information about next transportation mode.

10. Long dwell times of the containers at the port.

11. Large terminals are not keen to help in case of emergency or rush order.

12. Slot at which transportation is performed.

13. If delivery is delayed due to major disruptions beyond company’s control, truckers are expected to perform in accordance with the schedule as soon as the issues are resolved.

The discovered problems are used in order to increase the learning effect of the game. It is decided that they have to be embedded in the game in such way that the lack of SSA will cause these problems and the high levels of SSA will solve them.

The next step performed during the creation of this thesis was designing of the game session. First, it was necessary to define the structure of the game session: lecture, discussion, game briefing, game, game debriefing and final discussion. Then, an analysis was performed to determine which parts of reality should be included in the game. It is decided that following actors must be actively played in the game: container terminal, forwarder, the truck operator and the barge operator. Several other actors that have an influence on the inland transport but cannot be identified as a key actors are played passively in the game: customs, competitors, shipping lines, end customers, warehouses. From the discovered problems which occur in inland transportation the set of problems is chosen which has the most potential to increase SSA of the players, from list mentioned above the following problems are included in the game: 1, 2, 3, 5, 6, 7, 9, and 11. The rest of the problems are concluded to be impossible to implement, or lead to increased complexity of the game.

The next step in the game design process was to pose the learning objective on the final game design: game must be playable, realistic, and carry a learning objective. To evaluate the game afterwards, the requirements are posed at the beginning of the game design process. After this step the game development is executed. The process consisted of three rounds:

- Round I. During this round 4 game concepts are proposed: role game, card game, board game and quiz. After evaluating each of this concepts it is decided to design a game which includes the elements of each concept.
Round II. The concept chosen in Round I is detailed into the game. After the evaluation of the designed game, it is concluded that the game does not satisfy the objectives. The feedback is used to design a new version of the game. About 10 game versions were designed in total. Due to minor changes among several versions, three main game versions are distinguished. In the first version the realism was the driving idea, however it led to the extreme game complexity what made the game not playable. In the second version of the game, the reality factor was reduced. The result was sufficient to make the game playable, but still there were problems regarding some game mechanics and the imbalance in the game load experienced by different players. In the latter version of the game this issue is fixed and it is concluded that the last version satisfies the objectives and requirements of the game.

Round III. In this round the game is finalized, the attention is paid to the form and layout of the game elements, the easiness of the text, etc.

Due to the learning objective of the game, it is important to measure the effect of the game on SSA of the players. Different methods exist, in this thesis it is found that the following methods are appropriate to be used for designing of the game: self-rating, observer-rating, performance measures.

The game session is led by the game which has a range of various responsibilities: organizing the game session, giving lecture, explaining the game, controlling the game execution, leading discussion on the results of the game. The last game master role is found to be extremely important for the learning objective of the game as it helps to link the game experience with the reality.

The key component of the game session is the game. In the final version of the game there are 3 players: Container Terminal (CT), Transport Operator (TO) and Shipping Line Agent (SLA). The role of the Central Bank is played by the game master. Players have to organize the transport for transport orders, both export and import. Each player has the set of actions and attributes to perform his part of transportation. The game is designed in such a way that all the activities can be performed having low SSA, however as SSA increases the game performances of the players go up. To make this clear, the game can be divided into two phases: Low SSA and High SSA. In the first phase there is a ban on communication between the players and there is a wall between players parts of the game, the wall hides players activities from each other. At some point in the game the wall is removed and the communication is allowed, what can be seen as an increase in the level of SSA. The problems that occur during the first phase can be relatively easily solved during the second phase. This game design makes a clear difference between high and low levels of SSA. Most of the problems embedded in the game are derived from the real problems, however the solutions to these problems can be impossible for the reality. The main idea is to show the positive effect of SSA and not to come up with the solutions.

The game is tested during the designing process. However, these tryouts were performed with students, and in order to evaluate the final version of the game, the final tryout were done with the target group. Three players were invited to the tryout, representatives of the following inland actors: container terminal, transport operator and forwarder. Game session consisted of lecture, game and game evaluation. The pre-game discussion was not performed due to the lack of questions after the lecture. The game tryout showed that the game is playable, however due to high initial complexity of the game players had difficulties in learning how to play the game. After several players learned how to play the game, they became interested in the game mechanics. During High SSA phase compared to the
Low SSA phase, players performances are increased due to extensive communication and negotiations.

The effect of the game on SSA is evaluated by means of three techniques: observer-rating, performance measures, and self-rating. It is observed by the game master that during the High SSA phase of the game, players were monitoring each others plans and actions, they were negotiating almost each action which could have a consequences on other players, what shows higher level of SSA. These collaborative decisions and actions led to higher game performances, what according to the performance measures technique can be seen as increase in SSA. After the game players were asked about their opinion on the game. They concluded that this game shows the positive effect of having higher levels of SSA. Combining the results from all the three methods it was concluded that the game reached the objective: to show the positive effect of having higher levels of SSA.

After the final tryouts, the game session is evaluated, with the focus on the game. The game is quite complex and should be evaluated from four perspectives:

- **Playability:** game mechanics are found to be complex, however after the certain learning period players understand the game completely and enter into the Flow state. The players show interest in maximizing their profits.

- **Meaning:** game shows positive effect of having higher levels of SSA.

- **Reality:** most of the game aspects are based directly on reality or derived from reality. Aspects that are added to increase the playability do not have negative consequences on the learning objective of the game.

- **Requirements:** game satisfies most of the requirements posed before the start of the game design process, the requirements which the game fails to satisfy are minor and do not hamper the game learning objective.

To sum up the designed game session successfully reaches the proposed objective of showing the positive effect of having higher levels of SSA in inland transport. As an application target group, which can profit the most from the designed game session, students of logistics studies and new employees of the transport companies are identified. The usage of this game for more experienced employees is highly unlikely as the game session takes 3 hours and the financial benefits from participating in the game are not directly visible.

### 8.2 Recommendations

In this section the recommendations are given to the actors involved in inland transport at the Port of Rotterdam. This is followed by the recommendations for the further academic research.

The global recommendation to the companies is to Increase Shared Situational Awareness. However, to follow this recommendation it is important that the industry feels the need for higher levels of SSA, what at this point is not a valid assumption.

**Business implications.** The companies involved in inland transport do not show high levels of Shared Situational Awareness. The knowledge of the processes of other
parties is limited to the facts that are required for daily operations. If this is not directly required, companies do not feel the need for higher level of SSA. Individual employees may know much about other parties but it is often caused by personal interests or/and experiences of the employees. This lack of SSA results in inefficiencies and problems during the execution of daily operations. Some of the current problems, such as information about next transportation mode or information about the broken container, can be resolved by simply informing each other regarding a certain activity, but due to low levels of SSA nobody does that. Other problems (waiting delay at gate in, berth time requests, horizon of planning, etc.) are more complicated and they require more than increased communication, however due to low levels of SSA there is no intention to solve these problems from parties both problem causing and problem experiencing.

To break the ice, parties have to realize that there are problems, which can be solved by increasing SSA. The design of the game has potential to show the impacts of the actions on each other, to learn about the problems which actors experience, and ultimately to feel the need for higher levels of SSA. We recommend organizing a game session described in this thesis for the employees to demonstrate the positive effects of the SSA on the performances of the actors. However, it is unlikely that senior employees will agree to participate. Nonetheless, the participation solely of new employees can have an even more positive effect: they are more open for new things, and thus can learn from the beginning about the concept of SSA, they are more likely to use it further in their career.

**Future research.** The performed project had a limited scope, in which only container terminals, inland carriers and organizers were investigated. Only 2 barge operators, one truck operator, one small shipping line and one forwarder were interviewed. For more fundamental study it is necessary to perform more interviews with different parties, it is crucial to include Container terminal in the research. Also it should be noticed that the inland transportation is much wider, and other actors should be included into the scope of the similar projects: major shipping lines, end clients, etc.

In this research the communication is concluded to be the link between the low and high levels of SSA. However, no study is done on how valid this is. Also the exact working principle of the communication on SSA is not established. These aspects have to be also revealed in further researches.

The effect of the game on SSA is only derived based on the observations during the game and debriefing of the game results. SSA of the players should be measured upfront using different methods, ideally not at the certain moment, but over long term. After the game is played, the level of SSA should be measured again, and the long-term effect of the game is recommended to be evaluated after several months and years.

In this thesis it is concluded that higher levels of SSA lead to increase in the performances. However it is interesting to discover the quantitative results of the high levels of SSA on the performances in inland transport: increased throughput of the containers, decreased costs, lead to less problems, etc. Thus, it should be investigated how to link the level of SSA on the KPI in quantitative matter.

During this thesis a number of difficulties were encountered during the game design process. One of the main reasons is the vagueness of the SSA concept: it is not trivial to translate the reality so that SSA factor plays a major role. To protect further game developers from this problems, attempt has to be made to draw the guidelines for the game design for SSA games.

The last recommendation concerns the game itself. The designed game is a board game,
however the idea of having all the players at the same table, even with the wall, already increases SSA. Instead it is interesting to investigate the effect of the similar game but implemented on the computer, as it has the potential to simulate real everyday activities of the planners, sitting behind screens. Also the computer-based game will ease the controlling role of game master and let him fully concentrate on SSA aspects.

8.3 Contribution to SALOMO project

This project is a part of SALOMO project. During this project a number of activities was performed which contribute to this project. The hinterland transport was investigated and analyzed. Number of interviews with the representatives from the industry were performed which revealed the processes that take place at forwarders, barge operators, shipping line agents and truck operators. From these interviews a number of problems which the actors experience in hinterland transport were identified. The final contribution to SALOMO project is the developed game that is capable of increasing Shared Situational awareness in hinterland transport.
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Appendices
A.1 General Game Description

A.1.1 Game Objective and SSA

The objective of this game session is to show the difference between not communicating and communicating with respect to the game performances of the individual players. This objective is translated to the game, where the players can feel the positive effect of increase in SSA awareness. This effect is modeled by letting players to experience the current situation in the chain, where the lack of SSA results into the decreased performances of the players. This is done by isolating players from each other and by not allowing the communication. After that the players are allowed to monitor each others activities and to communicate with each other. It is assumed that these results in higher levels of SSA, what directly translates to better game performances of the players. To increase the effect the game is supported by the lecture, discussion and debriefing.

A.1.2 Game Description

There are 3 players in the game: Shipping Line Agent (SLA), Transport Operator (TO) and Container Terminal (CT). Players sit around the table where the game map is placed. Players operate only on their own part of the map. The interaction between the players is regulated in the game rules. The main objective for all players is to transport the game containers from inland warehouse to the sea-vessels and back. The participation of all the players is required to transport the containers. SLA receives orders and arranges the documentation, TO performs the physical movements of the containers from warehouse to container terminal, CT processes the incoming containers and loads them to the sea-vessels. All these activities do not require high levels of SSA. However, if SSA increases, many of the problems can be solved.

Game master has a set of events which he can throw into the game. The events describe a certain unpredicted situation which has occurred in the chain. The receiver of the event has to react to this event. In case of low SSA, events are handled as required by the game rules, however if SSA increases players can predict the consequences of this event to all players and act accordingly.

Besides, each player has activities which can be performed without involving other players, these elements are introduced in order to distract players from main game role. To focus the players attention on certain problems and show that these problems are important the concept of money is introduced. Rewards or costs are linked to almost all actions in the game, the amounts are not realistic, they are chosen in order to increase educational effect of the game. Each player receives the game elements needed for him to play the game.
A.1.3 Game Structure

Game consists of days. Each day each player has its turn. He is allowed to perform certain number of moves in his turn. The game is played in 1 round, however during the round different stages can be distinguished:

1. Learning: the game mechanics are learned by "doing", thus several game days are played where each game element is introduced to the players by the supervision of the game master.

2. Lack of SSA. In this round from 5 to 10 game days are played game. Each player performs his tasks. The lack of SSA is simulated by the wall which isolated each player's activities from other players. Along with all the game rules, in this round it is not allowed to communicate with each other. It is expected that the players cannot cooperate and align each other's actions with each other what leads to the decreased performance and some problems.

3. Increased SSA. After 5-10 days playing "Lack of SSA" stage, the wall between the players should be removed. At the same time the players receive the hints from the game master about the problems they have encountered and possible solutions to these problems. This time the players are allowed to communicate freely with each other, they are allowed to share any resources they want and to negotiate the tariffs. During this stage the players should experience less problems and show the increased game performances.

The players are asked to keep a track on problems they encounter. In the second stage of the game Game master keeps track on the shared decisions taken and how it has improved the game results. If the players do not use the opportunity to communicate in the right direction, the game master can decide to give more explicit hints.

A.2 Game Master Manual

Game master is not an active player in the game. His main role is to maximize the learning effect of the game. In each phase of the game session the game master has a number of tasks.

The first objective of the game master is to study the topics which are covered by the introduction presentation: basics of the Shared Situational Awareness, hinterland transport structure, problems of hinterland transport (all of it is covered in the previous chapters of this thesis). Besides, the game master must know all the game rules and aspects, which can be learned from the game manual. The next tasks of the Game master in the preparation phase are

- to prepare an interesting presentation based on the provided slides,
- to invite the participants for the game session,
- to reserve the room suitable for at least 4 people for 3 hours,
- to print Game Scoring Sheet (1x), Loading/discharge lists (40x), Diagrams, Players Game Manuals (2x of each, one for the player and one for the game master), Game Master Manual,
• to check the room before the game session,
• to place the game attributes as depicted in Appendix B.1

At the beginning of the game session, game master seats the players around the table as presented in Appendix B.1. He gives the presentation on the Shared Situational Awareness and Hinterland Transport. When all questions are answered, the game needs to be explained. Game master asks each player to share the expectations about the game, and if some of them are far from the reality, the game master must explain unclear things. Before the game starts game master distributes the game manuals between players.

During the first game days, the game master has to help the players to learn the game mechanics, which extensively described at the end of the Game Master Manual, during these days the game is played sequentially: SLA, then TO, then CT. If game master gets a feeling that the players understand game mechanics, the players start playing in parallel. The game master tasks are as follows:

• Controlling the execution of the game rules, collecting money from the players and giving the rewards.
• Filling in the information about the orders into the registration system, and in case if players have questions about it, answering the questions.
• Throwing the events each several days and monitoring whether the players handle the events properly and registering it in the Events table of Game master scoring sheet.
• Counting the unneeded actions which lead to extra costs for the players and noticing it in Money Spend due to lack of SSA table of Game Master Scoring System sheet.
• Registering all the Shared decisions of the players during the second round and their consequences by filling in SSA decisions table of the Game Master Scoring System sheet.s
• Giving hints if needed during Round Two to guarantee that the players are aware of the possible solutions to their problems.

When game master notices that the players developed a routine (after about 5-10 days) the game master stops the game. Players are asked to share their problems, the game master gives the hints about the possible solutions to these problems. Before continuing the game the wall has to be removed and the game master has to explain new rules during which it is allowed to communicate, to negotiate everything, etc. After that the game is played for additional 5-10 days. After the game, Game master shares his observations with the players. Also the players are asked to express their opinion about the game and the effect of the game on SSA. This is used as a starting point for the discussion.

A.2.1 Players game attributes

Before the game, game master places each element of the game as follows:

• game map elements as depicted in Appendix B;
• money stack near the seat of the game master;
• orders stack near the Shipping Line Agent seat;
• red game containers at the warehouse;

• blue game containers near the sea-vessels;

• containers of external orders to the Eternal orders;

• barge with external container at Loading place (barge route) heading towards container terminal, one barge with external container at STOP, REQUEST BERTH TIME (barge route) heading towards warehouse, the same for trucks but along truck route;

• extra trucks, which can be hired near the truck route;

• other sea-vessel at Day 1 place near Berth 2 at container terminal;

• game container #1 at Export Stack;

• game container #21 in sea-vessel Drenthe;

• Filled in discharge/load list for Day 1 for containers 1 and 21 near CT;

• Order card for order #1 near TO;

• 15 containers at Terminal Containers at Export Stack 2.

After all the attributes are placed, the game master has to provide the players with game attributes which are used during the game. Here bellow all the components and the players which receive it are mentioned:

1. Money: All Players – 80 Stars, the game master holds the rest of the money;

2. Diagram: All Players;

3. Gate Delay Card: Container Terminal;

4. Berth Time request cards: Container Terminal and Transport Operator – the actors type is given on the card;

5. Dices Colored: Shipping Line Agent;

6. Normal Dice: Container Terminal;

7. Customer Information: Container Terminal;

8. Loading/Discharge list: Shipping Line Agent – at least 40 lists has to be given to the player;

9. Bonus/reward table: All Players – each player receives own bonus reward table, the player type is mentioned on the table.
A.2.2 Events

A number of the events is present in the game. The events are thrown by the game master. Game master decides himself when and which event to throw, however, certain conditions has to be fulfilled. The idea of the events is to evaluate the level of the awareness of the players by monitoring the actions taken by the players to handle the event. There are two possible ways to handle the event: as required (thus following the rules of the game), or as desired (performing actions which are not required but can influence in positive way other players). Further, the events, the actor which receives this event, the conditions to throw the event, required and desired ways to handle each event are presented:

1. Broken Container is found on the barge (Transport Operator). When: one of the barges is heading to Container Terminal with the game container. Required handling: inform Shipping Line Agent. Desired: Container Terminal has to be informed by one of the players so that he puts the container direct from the Dedicated Export Barge Stack to the Repair Shop.

2. Truck is broken for two days (Transport Operator). When: one of the trucks is heading towards warehouse with the game container and there are game containers waiting for it at the warehouse. Required handling: hire extra truck to finish the transport. Desired handling: inform Shipping Line Agent, ask for the costs for SLA of extra two days transportation, agree to cover them.

3. Main Gate cannot serve trucks for two days (Shipping Line Agent). When: one of the trucks is at the second step heading towards the warehouse. Required handling: do nothing. Desired handling: inform Transport Operator so that he redirects the truck to the secondary gate of the warehouse.

4. Rush Order (Shipping Line Agent). When: one of the sea-vessels of Shipping Line Agent is visiting the terminal, put the external container to this sea-vessel. Required handling: do nothing. Desired handling: load this container to the inland transport (truck) during the turn of Shipping Line Agent, thus Container Terminal has to agree to unload the container direct from sea-vessel to the truck and Transport Operator has to hire extra capacity.

5. Crane Serving trucks is broken for two days (Container Terminal). When: one of the trucks is almost near Container Terminal. Required handling: do nothing. Desired handling: inform TO so that he can put the trucks on other jobs or to unload the container at CT2, inform SLA to let him adjust his order taking activities.

6. Broken Container Found In Export Put into Repair Shop (Container Terminal). When: the broken container event is thrown and Container Terminal is not informed about this. Required handling: none. Desired handling: none, this event is a consequence of not proper execution of the Broken Container event of Transport Operator.

A.2.3 Unneeded actions

The game is designed is such way that players can achieve personal objectives within the given time without communicating with each other. However, this behavior leads to certain actions which are redundant, undesired or more efficient/effective alternative exists. In case
if the players communicate they can come up with the solution to this problems. In this section the unneeded actions are presented:

1. Waiting in the line at the Gate. The time that truck spends in the waiting line can be considered waste of time for Transport Operator. In the game each day of each unit costs money to Transport Operator.

2. Not found barge berth time. In case if barge cannot berth at Container Terminal, containers loaded on barge has to be unloaded at Container Terminal 2 and the transportation to Container Terminal 1 has to be arranged. At the same time, the import containers at Container Terminal stay at terminal till the next transport unit arrival. Time and money lost due to not-found berth time are wastage. In the game there are costs linked to arranging the transport from one terminal where the containers are unloaded to the terminal of the linked sea-vessel.

3. Hiring external transport. The organizing parties in the chain often work with known and trusted carriers. Hiring external transport operators can lead to unnecessary risks and higher rates rates. In case of hiring external transport in the game, transportation takes longer and the revenues are less.

4. Taking external orders. As in case of taking an order from an external party, Transport Operator can experience extra costs due to the orders from not-known clients. In the game external orders bring less revenues for Transport Operator.

5. Stacking the containers in the General Import/Export Stack. Each container move at the terminal costs money to the terminal. Unnecessary moves from one stack to other stacks, shuffling moves, etc. has to be minimized. In the game, it is possible to move the containers directly from land dedicated stack to the sea dedicated stacks, however, only if the next transportation mode is known.

6. Handling the event in not proper way. In case if the event is handled not properly, one of the party can experience losses. In the game, the event can be handled properly, what minimizes the costs for the player.

7. Not hiring extra truck. The costs for extra truck are slightly higher for TO than the reward from SLA for transport. However, the prices could be negotiated, so that it is desired for both SLA and TO to hire extra trucks, but without communication it is not possible.

8. Not taking a fast route for trucks. The costs for taking a fast route are on TO, however if the truck moves faster, SLA receives bonus, which is higher than the truck costs. Communication between actors could lead to bonus sharing agreement.

Each time one of this actions is executed, the game master has to notice it in the scoring sheet. If the players get a feeling of Shared Situational Awareness, they can reduce frequency of occurrence of these actions in Round Two by communication with each other.

A.2.4 Hints

After the first round, short discussion is held about the results and players experiences from Round One. During this discussion, the game master gives hints to make the players aware about some solutions to the problems they experienced. Game master decides himself
about what kind of hints he provides to the players. The hints should concern the following aspects:

- Inform the other players about the own situation even if it seems unnecessary.
- Link the situations of other players to own situation
- Look at possible actions: different information cards, hiring extra gate capacity, sharing customer information, hiring extra transport units, etc.
- Propose to share costs/revenues: fast route for the truck, rush orders, hiring extra gate capacity, hiring extra transport unit, etc.

A.2.5 SSA Decisions

Discussion about the solution of problems from the first rounds and hints given by the Game Master has to lead in Round Two to decisions made by the players. The unneeded actions described previously can be (partly) resolved if the players agree to take certain decisions. It should be noticed that these are not only possible solutions, other decision, unforeseen by the game designers can be taken if they are not contradictory to the game rules. Further in this sections possible decisions are listed:

- Truck registration system. Container Terminal determines the gate delay for coming 3 days each time the truck arrives. Instead of announcing only gate delay for one day, players can agree that Container Terminal does it for all three days.

- Hiring extra capacity for gate processes. As in previous decision, the losses of the trucking company due to the gate delay, can be eliminated in case if Container Terminal hires extra capacity. The costs can be shared.

- Berth time. Instead of using current protocol for berth time request, in which barge requests particular time-slot and Container Terminal responses by saying yes or no, the barge can mention all the available time-slots. Container Terminal can implement this protocol for time request of external barges, so that they submit all the available time-slots (Berth Time Request cards has to be replaced by Berth Time Request Round 2 cards). It will increase the chance of receiving the berth time.

- Hiring extra transport units. In different cases, it can be advantageous for Shipping Line Agent, that extra truck is hired to keep the transportation time of the container low.

- Fast Route for trucks. The bonus for SLA for fast transportation is higher than the costs of going a fast route for TO.

- Providing customer info. Shipping Line Agent is interested in knowing about the customer types. Container Terminal has this information. Container Terminal can agree to provide this information to SLA.

- Early registration of next transportation mode. Container Terminal is interested in knowing the next transportation mode as soon as possible. Transport Operator or Shipping Line Agent can agree to decide earlier and inform Container Terminal about the mode of transportation.
• Events. All the information about the events can be shared with not only the required parties, but with other players.

• Sharing costs, negotiating prices, etc. Several possibilities to share the cost of some actions are described. In general it is allowed to negotiate all the prices which concern inter-players actions. Also it is possible to share the costs if agreed.

Each of these decisions has to be registered by the game master in the scoring table. The consequences of the decisions can be various: better planning, decreased costs, better information exchange, etc. The game master has to identify and register the linked between the decisions and changed game performances of the players.

A.2.6 Evaluating Shared Situational Awareness

To evaluate the Shared Situational Awareness the combination of three methods is used: observer-rating techniques, performance evaluating and self-rating. The game master is responsible for the evaluation of the game session results.

The first method implies observing the players behavior during the game and evaluating it. To support this, the game master is provided with the Scoring Sheet where the aspects required to be monitored during the game are presented. At the end of the game, Game Master compares the results for the first phase of the game with the wall and with the results from the second phase.

The second method is based on counting the money of the players. Lack of SSA results in more loses for the players. The second phase of the game leads to better financial results for the players.

The third method implies using the expertise and experience of the players in the field. During the evaluation phase of the game session players are asked to share their opinion about the game and which effect it has on the level of Shared Situational Awareness.

The opinion of the players together with the results from two first methods are used as a starting point for the discussion.

A.2.7 Game Elements

In the game a number of game pieces are involved. In this section each piece is described.

A.2.7.1 Game Manual

In the game manual all the aspects of the game are described: why this game, what it represents, game rules, game objectives, etc. Two versions of the game manual exist: one for the players and one for the game master. Game master manual is extensive, Players manual is short and only aspects concerning the players activities are discussed in it.

A.2.7.2 Containers

Container is a basic game piece. It is transported, moved, loaded and unloaded during the game. There are several types of the containers:

1. **Game Containers.** Short Blue (export) or Red (import) containers which are played by all players in the container chain, they also have the serial number.
2. **External Containers** Short containers (any color except red or blue), which are used to simulate the external cargo for Transport Operator.

3. **Terminal Containers.** These containers are used to simulate everyday operations of Container Terminal, these containers are loaded to the incoming sea-vessels.

**A.2.7.3 Diagram**

Diagram shows all the steps required for execution of transport orders, both for export and import containers.

**A.2.7.4 Order Card**

The order card is linked to the certain container (order number = container number). The order card is used to give a transport order to the transportation chain. Each order card has the following fields: Order Number, Customer Name, Direction of the order (import/export), hinterland transport mode (Truck/Barge), sea-vessel name. Each container is linked to certain ship in the game.

**A.2.7.5 Releases**

Each order needs to get a release for the transport. Export order requires PickUp release and Customs release. The former is required to pick up the goods from the warehouse. The Customs Release is required to Enter Container Terminal. For the Import Container the Customs release must be granted, without which the container cannot be transported away from the terminal.

**A.2.7.6 Truck Registration Cards**

Truck Registration cards used to determine the truck waiting route. On each card certain path is written, which should be followed by the truck units.

**A.2.7.7 Berth Time Cards**

Both Container Terminal and Transport Operator have a stack of cards used for Berth time negotiation. On the Berth Time Cards of Container Terminal the visiting time external barges is stated, the Berth Time Cards of Transport Operator state the visiting time of the barge to other three terminals. In case if Transport Operator and Container Terminal agree to cooperate during the berth time request, the Container Terminal Stack is replaced by the Stack Berth Time Request Round 2, where multiple visiting time slots are stated for the incoming barges.

**A.2.7.8 Event Card**

There are several unpredicted events in the game, they are brought into the game by the game master when the time is appropriate for this event.
A.2.7.9 Customer Types

There are two types of Customers: good and bad. The good customers have a perfect transportation history and always fulfill all their financial obligations. The bad customers are new to this business and their financial state is not stable. The types influence the chance of getting transport releases on time. The information about this types is presented in the list, which is given to Container Terminal.

A.2.7.10 Dice

Dices are used to simulate the non-deterministic processes. They are used to simulate the number of barges visiting Container Terminal and the response for the arranging the releases. The former is done by using one standard 6 face dice. For latter the colored dices are used: green, white and red. On these colored dices the result for the arranging the documents is depicted: OK and NO. Dice with different colors have different probabilities of these outcomes.

A.2.7.11 Customer Types

The successful obtainment of the releases depends on different factors such as the origin of the goods, the port of calls of the sea-vessel, the relations between sender and the receiver of the goods, etc. In this game these factors are implemented by two different type of Customers: good and bad. The good customers have a perfect transportation history and always fulfill all their financial obligations. The bad customers are new to this business, and their financial state is not stable. The types influence the chance of getting transport releases on time. The information about this types is presented in the list, which is given to Container Terminal.

A.2.7.12 Order Registration System

There is a registration system for all orders. In this system all the aspects of the orders are listed:

- Order number: the order number written on the order card;
- In/Out: indication whether the order is already taken by Shipping Line Agent (In field) and whether this order has be transported already (Out Field);
- I/E: indicates the direction of the containers: I - Import, E - Export;
- PickUp, Customs: indicates the presence of Pickup and Customs Releases;
- Customer Name: Name of the Customer;
- Destination
- Customer Type: the type of the customer
- Carrier: Inland transportation mode

The game master fills in this table. Other players can address the game master to ask certain information mentioned in this table.
A.2.7.13 Game Master scoring sheet

Game master has a scoring sheet, which is used to evaluate the game performances. In this sheet several tables are present for each round:

- **Players objective.** Table used to count the execution of the global and personal players objectives: transported game containers, processed sea-vessels for Container Terminal, orders processed by Shipping Line Agent and containers transported by Transport Operator.

- **Events.** All events are listed in this table, the game master puts a check in the corresponding cell in case if the event is handled properly.

- **Money Spent due to lack of SSA.** Actions which are considered to be redundant or unnecessary are listed in this table. If this action happens the game master notices that.

- **SSA Decisions.** In the second round the players are allowed to communicate and it is expected that they will take collaborative decisions, the list of embedded decisions is present in the last table, the game master notices the consequences of this actions when it happens. Empty fields are present in case if the taken decisions are not foreseen by the game design.

A.2.7.14 Loading/Discharge List

Before the arrival of the sea-vessel, Shipping Line Agent must submit the discharge/loading list to the Container Terminal, indicating which containers must be unloaded and loaded to the sea-vessel. Loading/discharge list is represented by the table where the order numbers, sea-vessel and the day must be filled in by Shipping Line Agent.

A.2.7.15 Money

The game makes a use of money as a performance indicators and as a tool for learning. The secondary purpose of the game money to increase the interests of the players to play the game. The player can accumulate more money if the chain increases its SSA level. The name of the game currency is Stars. There are banknotes of following nominal: One, Two, Five and Ten Stars. The price is linked to almost each action of the actors. The prices are chosen in such way that in case of fully correct order execution all players gain a same amount of money, and the wrong actions decreases this amount to them or to others. Each actor receive the initial amount of money to be able to operate. The initial amount is chosen is such way that during the game, the players have sufficient amount of money to operate, however, the pressure to save money is still present.

A.2.7.16 Inland Transport units

Inland part of the transport is performed by two types units: barge and truck. The capacity of each transport unit is one container. The barge and trucks use different paths to reach the Container Terminal.
A.2.7.17 Sea-vessels

The sea-vessels are the units which visit the sea-terminal from the sea. Two types of the sea-vessels exist: game sea vessels, and other sea-vessels. The former transport game containers to and from Container Terminals, and stay there for one day. They are the starting point in the game for the import containers and the end point for the export containers. There are Game sea-vessels: Drenthe, Brabant and Limburg.

Other sea-vessels are the vessels, which transport Container Terminals, they stay at the terminal for maximum 3 days, or leave when they are loaded with 15 containers. There are two of the Other sea-vessels. One is placed on Export Stack with 15 containers, the other is near Berth 2, when all the containers from one sea-vessels are loaded to other one, they exchange places.

A.2.7.18 Game map

The game is played on the map, which can be virtually divided into 5 parts.

- Sea and berth. There are two main berths: berth for the sea-vessels which are operated by Shipping Line Agent, and berth for the Other sea-vessels. Each ship of the SLA has its own dedicated part-berth.

- Container Terminal. Container Terminal is a set of different stacks. Each stack has its own purpose, the moves between the stacks are regulated by the game rules. The stacks are:
  - Dedicated Barge/Truck Stack (export/import). The containers unloaded from the Barges/Trucks are put into this stack (export), the barges/trucks are loaded from this stack (import). It is only possible to move the container into Dedicated Stack only if the next transportation mode is known for the import container.
  - Export Stack 1, the containers which are delivered by the hinterland transport are moved to this stack.
  - Export Stack 2. The Terminal Containers are placed initially into this stack.
  - General Import Stack. The containers from the sea are moved to this stack.
  - Dedicated Sea-vessel Stack. The sea-vessels operated by Shipping Line Agent have dedicated berth. Each vessel has its own dedicated stack, to which the sea-vessels are unloaded, and from which they are loaded. The containers can be placed to the export stack only if the corresponding sea-vessels is known by Container Terminal.
  - Repair shop. The broken containers has to be moved to this stack.

- Entrance to Terminal. The Inland transport units enter the terminal via Entrance. Barge and Truck enter terminal via different paths. The Truck goes through GATE. There are 6 Delay Routes for the truck, once in the line, the truck cannot turn around, it must stay there until it is served. Before terminal visit, the barge must request the berth time. Near the entrance to played Container Terminal, there is Container Terminal 2, which is used as destination for the external orders of Transport Operator. This terminal can also be used in case of emergencies to unload the containers with the destination Container Terminal 1. It takes a day to transport the game container to the Container Terminal 1 from here.
• Land. The transport unit moves between warehouse and terminal. The trip takes three days for each unit, there is a possibility for the trucks to accelerate and finish the trip within 2 days. In case of emergency the route to the second gate of warehouse can be used. There is a place near Container Terminal, where the trucks can stay free of charge for several days. The second day of the trip (the middle step) is a moment when Transport Operator is allowed to take external orders from External Order Stack.

• Warehouse. There are two gates at warehouses: main and secondary. The secondary is used only in case of emergency. Warehouse is used as a point of origin and as a destination for the containers. It is divided into two parts: Not Released and Released. The former is the storage place for the export containers for which there is not pick up release yet, the later is for the delivered import containers and export containers with pick up release.

A.2.7.19 Wall

It is previously mentioned that the wall is used to make the actions of the players not visible to each other, so that their SSA does not increase due to overlooking. The wall separates the game map into three parts, each player has its own part.

A.2.8 Game mechanism

In this section the game mechanics are explained for each game action, along with the name involved actors are stated:

1. New Order. Who: Shipping Line Agent; How: pull the Order card from the Order Cards Stack; Game master writes down the order card number and other order aspects in the Registration System.

2. Arranging the Release. Who: Shipping Line Agent; How: throw two dice for each release (Green for good customer type, Grey for Unknown and Red for Bad customer type,) and look up response in the table based on the thrown number:

   • OK: receive documents; Game masters puts the check at the corresponding column in ORDERS Registration table; for Pick Up release move the container to the ”Released area”.
   • Try next day: do anything for this order this day
   • NOTE: customs release for import container can be only arranged when the container is at terminal


4. Giving Export Transport Order to External Operator. Who: Shipping Line Agent; How: pay transport fee to the game master; when Pick up and Customs releases are granted, put the container 6 days from now at the day count, when this days comes, receive money from Game Master.

5. Sea-vessel Arrival. Who: Shipping Line Agent; How: each day shift the berthed sea-vessel to the sea and shift the next sea-vessel towards berth; the order at which ships
arrive is not determined, the player decide himself, on which day which sea-vessel visits the terminal, one at the time.

6. Submitting the discharge and load lists. Who: Shipping Line Agent; if there are containers on the arrived sea-vessel which has to be unloaded or there are containers at Container Terminal yard which has to be loaded to this sea-vessel, fill in the discharge/load list by stating the order number in corresponding column and give it to Container Terminal, for each listed container pay fee to Container Terminal.

7. Request Rush Order. Who: Shipping Line Agent; How: verbally ask CT and SLA to transport this order the same day.

8. Broken container. Who: Transport Operator; How: when the event Broken container event card received, notify Shipping Line Agent about the broken container by giving him this card.

9. Moving along route. Who: Transport Operator; How: each day move one step towards the destination by all the transport unit.

10. Receiving the transportation order from Shipping Line. Who: Transport Operator; How: Receive money, think about which transportation unit to use to transport this container.

11. Picking up the container from the warehouse. Who: Transport Operator; How: when the transport units arrives to warehouse, load the container to the transportation unit, leave next day.

12. Delivering the container to the warehouse. Who: Transport Operator; How: when the transport unit loaded with the game container arrives to warehouse, unload the container to warehouse, give the corresponding order card to SLA, leave next day.

13. Picking up external orders. Who: Transport Operator; How: during the trip from Warehouse to Port or back, at the point Take External orders, it is allowed to pick up external container from the stack External Orders and put into either to Container Terminal 2 (Import) or to the Released Part of Warehouse (Export).

14. Visiting Terminal 2. Who: Transport Operator; How: if there is an container on board of the transportation unit or there is a container waiting at Container Terminal 2, (un-)load the containers when near Container Terminal 1, if export container return the order card to SLA.

15. Truck Visiting Terminal 1. Who: Transport Operator; How: when near Container Terminal 1 request Container Terminal to give the Waiting line Route at the same time notify Container Terminal about the import container which needs to be loaded on the truck. When Received follow this Route, the truck is moved by Container Terminal in the line, when the truck is at last step, wait until the container is (un-)loaded, if export container return the order card to SLA and leave.

16. Barge Visiting Terminal 1. Who: Transport Operator; How: when near Container Terminal 1 notify Container Terminal about the visit, pull three cards out of Berth Time Response stack, which indicate the time of visit to Terminal 2, 3, and 4; name day part for barge to visit the terminal from one to 7 which is not taken by other
terminal, wait for the response from Container Terminal; if positive visit terminal next
day, wait until the container is (un-)loaded, if export container return the order card
to SLA, and leave, if negative, pay fee, unload the container to Container Terminal 2
and leave, move next day the container to the Dedicated Barge Stack.

17. Transport unit registration. Who: Transport Operator; How: When transport unit is
near CT, unit is loaded with the containers for CT or there are containers at CT which
transport unit is planned to pick up, show corresponding order card to CT.

on the truck route, only for one trip.

is near the gate, Transport Operator notifies about the container number it wants to
transport, move this container to the Dedicated Stack during Container Terminal turn.

20. Giving the Route for the Visiting Truck. Who: Container Terminal; How: when
Transport Operator requests the Route for the visiting truck, pull three cards out of
Gate Delay stack, these cards show the gate delay for this day and coming two days,
show the first card to the Transport Operator.

21. Truck Moves in the line. Who: Container Terminal; How: if truck is in the line, it is
required to spend one action a day on his move (one action = one step in the line), it
is possible to spend more actions.

22. Barge Visiting Terminal 1. Who: Container Terminal; How: When the barge is near
terminal, (1) Throw dice, the number of dice determines number of incoming barges;
(2) Pull for each incoming barge the card out of Berth Time Stack which indicate the
incoming time of the barges; (3) Respond to Transport Operator whether it is possible
or not visit the terminal at the requested time.

23. Offloading the import containers. Who: Container Terminal; How: if the container
sea-vessel has the import containers which are mentioned in the submitted discharge
list, they has to be unloaded to the Dedicated berth of this sea-vessel, receive money
for this action.

24. Moving the Import Container to Import Stack. Who: Container Terminal; How: the
container offloaded from the sea-vessel has to be moved asap to other stacks, it is
possible to move it to Import Stack by paying a fee.

25. Moving the Import Container to Dedicated Truck/Barge Stack. Who: Container Ter-
minal; How: when the next transportation mode is known for the import container,
move the container to Dedicated Truck/Barge Stack, pay money.

26. Moving the Export container from dedicated Stack to the Export Stack. Who: Con-
tainer Terminal; How: orders brought by the hinterland transport, are offloaded to the
dedicated stack, and must be transported from this stack, it is possible to move them
to the Export stack 1, pay the fee.

27. Moving the Export container to Dedicated Berth Stack Sea-Vessel Name. Who: Con-
tainer Terminal; How: if the sea-vessels is known for the export container, move the
container to the dedicated stack of this sea-vessel, pay a fee.
28. Loading Export containers. Who: Container Terminal; How: if the sea-vessel arrives, load all the listed in the Load list containers from the stack to the sea-vessel, receive money for each container.

29. Loading Export Other containers. Who: Container Terminal; How: there is a Other sea-vessel at Export Stack 2 with 15 containers, load the containers to sea-vessel at Berth 2, all the containers has to be loaded to the sea-vessel within 3 days, when all the containers are loaded exchange sea-vessels.

30. Hire Extra Capacity for truck handling. Who: Container Terminal; How: it is possible to hire extra capacity to handle the trucks at the gate: 5 Extra actions.

31. Received notification about Broken container. Who: Container Terminal; How: when the broken container card received, when container arrives, put the container directly to the Repair shop and pay fee.

32. Broken Container. Who: Container Terminal; How: container from the stack collapses causing 100 stars damage, the container has to be placed till the end of the game in repair shop, pay fee.

33. NOTE: Number of Actions. Who: Container Terminal; How: Container Terminal has limited number of actions a day, 8 Actions, each action described for Container Terminal requires one action per container.

34. Throw event. Who: Game Master; How: when it is appropriate time to throw the event, take the event card and give to the player which is stated on the card, in case if broken container event is thrown and CT is not informed until the container is received by CT, give the event card Broken Container CT to CT.

A.3 Manual Shipping Line Agent

Shipping line agent (SLA) is a owner of the sea-vessels. SLA performs the organization of the hinterland transport and the arrival of the sea-vessels to the terminal. SLA has three sea-vessels named Drenthe, Limburg and Brabant. Each sea-vessel has its own berth at the terminal. The visit of the sea-vessel to the terminal takes one day. In this game Shipping Line Agent is responsible for processing new orders, arranging the required documentation, giving the transport order for inland transportation and submitting the load and discharge lists to Container Terminal for the incoming sea-vessels.

The inland transportation can be performed either by the transport operator or by the external operator. If the player chooses for Transport Operator, he can choose the transportation mode (barge or truck).

**Everyday Actions:**

- Get new order.
- Arrange releases.
- Fill in and submit load and discharge lists for the sea-vessels to Container Terminal.
- Visit Container Terminal with sea-vessels.
- Give the transport order to Transport Operator or to the external operator.
Punishment Reward:

- Hire transport operator. Price: -12. Description: If the transport unit from the game picks up the order, this is the amount of money you pay to him for transport. This price can be negotiated.

- Order reward when the order leaves the game. Price: +35. Description: After the order leaves the game the Client wires money, this is the final reward for Shipping Line Agent.

- Costs per order per day. Price: -1. Description: The Shipping line agent is responsible for the transportation speed.

- Bonus if inland transport takes two days. Price: +10.

- Hire external transport operator. Price: -18. Description: Costs for hiring external transport operator, which arranges everything within 6 days.

- Order given but no release. Price: -5. Description: The truck arrived to the Warehouse or Container Terminal for the certain order, but it is not released.

- CT costs for (un-)loading the containers. Price: -10. Description: CT Charge for its service.

A.4 Manual Transport Operator

Transport Operator is responsible for the inland transportation of the containers between Container Terminal and inland warehouse. He receives the orders from the Shipping Line Agent or he can choose to take the orders from the external parties. The orders from the Shipping Line Agent are to transport the containers between the Warehouse and Container Terminal, the orders from the external parties, are between the warehouse and Container Terminal 2. The transportation is done by means of two barges and two trucks. There is a possibility to hire extra truck for one trip if needed. If transportation mode is not chosen for the order, the Transport Operator decides it by himself.

The distance between the warehouse and Container Terminal is equal to three days, however, the truck can accelerate and save one day. Each barge visits 4 container terminals each port call. Prior to the arrival of the transport unit to the container terminal, the transport operator has to submit loading and discharge lists to the Container Terminal. Additionally for the barges, the berth time has to be requested. If it is not possible, the barge cannot visit this Container Terminal and to unload the containers at Container Terminal 2. It can occur that the client of transport operator wants to use the second gate of warehouse, in such case redirect the transport unit to the second warehouse. For the trucks Container Terminal provides the waiting time at the gate.

Instead of waiting in the line at the Container gate, the transport operator can use the truck for other jobs.

Everyday Actions

- Transport unit is at warehouse or Container Terminal
  1. Offload the container to the Warehouse/Dedicated Export Stack
  2. Notify Shipping Line Agent about it
3. Load container, control the availability of needed releases.
4. When leaving, check if there is order for back journey. If not, it is allowed to take an external order.

- Transport between warehouse and Container Terminal
- Choose the transportation mode if not specified by the client
- Use Short cut for the truck
- If requested, visit second warehouse
- Submit Loading and Discharge lists to Container Terminal
- When approaching Container Terminal, Register Truck Visit/Request Berth Time
- If no berth time found, leave the container at Container Terminal 2
- Wait near Container Terminal 1 free of charge, if the waiting time is known
- It is not allowed for barge to wait anywhere along the route

**Punishment Reward:**

- Hire extra capacity. Price: -10. Description: Extra capacity for one day.
- Costs per day per transportation unit. Price: -2. Description: Gas fee, drivers salary.
- Reward for order transport. Price: 12. Description: Reward received from transportation of the orders from Shipping Line Agent.
- Reward for external order transport. Price: 8. Description: Reward received from transportation of the external orders.
- Unloading Game container at Terminal 2. Price: -10. Description: The transport order is not performed fully, external companies has to be enabled in order to transport these containers to CT1.

### A.5 Manual Container Terminal Role

Container Terminal is a transfer point from hinterland transport to the sea transport. The main responsibility of Container Terminal are (un-)loading of the sea-vessels, temporary storing the containers in the yard, and (un-)loading the inland transport units.

Terminal yard consists of several stack: Dedicated Truck/Barge Export/Import Stack, Export Stack 1 and 2, Dedicated Berth Stack Drenthe/Limburg/Brabant, General Import Stack, Repair Stack. The inland transport unit prior to the arrival to the terminal registers its visit by providing information concerning the containers on board and containers which needs to be loaded. For trucks, CT announces the waiting time, and for the barges the berth time has to be negotiated.

The container offloaded from the inland transport unit is stacked to the Dedicated Barge/Truck Export Stack. After that it is moved to the Export Stack 1. If the corresponding sea-vessel is known, the container is moved to the Dedicated Export Stack Sea-vessel.
When Sea-vessel arrives, it is loaded to it. For the import containers the reverse flow holds. When the sea-vessels arrives the container is unloaded to Dedicated Import Stack Sea-Vessel, then it is moved to the General Import Stack, from which to Dedicated Barge/Truck Import Stack. It is allowed to move the container from Dedicated Barge/Truck Export Stack to the Dedicated Export Stack Sea-vessel if the corresponding sea-vessel is known upon the offloading from the inland transport unit. The same holds for the Import Containers: if the next transportation mode is known during the offloading of the container from the sea-vessel, it can be moved directly to the Dedicated Barge/Truck Import stack.

The Export container is allowed to be unloaded to the terminal only if the Customs release is present. The Import container is loaded to the barge/truck only if there is a Customs release and Shipping Line Release is present. The loading and offloading of the containers to/from the sea-vessels is only possible if the container is mentioned in the load/discharge list.

Container Terminal is visited not only by the sea-vessels owned by Shipping Line, there is Other sea-vessel which visits the terminal. This sea-vessel visits the terminal, after it is fully loaded it leaves and the next day it visits Container Terminal again. Container Terminal has to load them with 15 containers from the Export Stack 2 within three days.

Container Terminal is a big party in the container transportation and it has an access to the information about end customers, where the payments and Customs history is depicted. This information is irrelevant for Container Terminal activities.

**Everyday Actions.** Container Terminal has only 9 actions each day. Near all actions cost Container Terminal money.

- Offloading the import container which are mentioned in the discharge list to the Dedicated Import Stack Sea-Vessel (Reward 10 Stars, Price: 1 Container = 1 action)
- Moving the import containers from the Dedicated Import Stack Sea-Vessel to General Import Stack (Price, 1 Container = 1 Action+ 2 Stars)
- Moving the import containers from the Dedicated Import Stack Sea-Vessel to Dedicated Import Barge/Truck Stack, if the next transportation mode is known (Price, 1 Container = 1 Action+ 2 Stars).
- Moving the order to the Dedicated Barge/Truck Stack not in turn of Container Terminal, when the inland transport unit mentioned the container in the loading list arrives (Price, 1 Container = 1 Action+ 4 Stars).
- Moving the import containers from the General Import to Dedicated Import Barge/Truck Stack, if the next transportation mode is known (Price, 1 Container = 1 Action+ 2 Stars).
- Loading the Import Container to the inland transport unit if it is mentioned in loading list.
- Offloading the export containers from the inland transport unit to the Dedicated Barge/Truck Export Stack
- Moving the export containers from the Dedicated Barge/Truck Import Stack to the Export Stack 1 (Price, 1 Container = 1 Action+ 2 Stars)
• Moving the export containers from the Export Stack 1 to Dedicated Export Stack Sea-Vessel, if and only if the corresponding ship is known (Price, 1 Container = 1 Action+ 2 Stars)

• Moving the export containers from the Dedicated Barge/Truck Import Stack to Dedicated Export Stack Sea-Vessel, if and only if the corresponding ship is known. (Price, 1 Container = 1 Action+ 2 Stars)

• Loading the export containers to the sea-vessel if mentioned in the loading list (Reward 10 Stars, Price: 1 Container = 1 action).

• Moving the broken container to the Repair Stack (Price: 1 Container = 2 Stars).

• Loading the Other Sea-vessels from the Export Stack 2 (Price, 1 Container = 1 Action), if loaded within 2 days, bonus is given.

• Giving the waiting time to the trucks

• Serving the truck waiting line at gate (Price: 1 move = 1 action).

• Negotiating the barge berth time

**Punishment Reward:**

• Moving Container within the terminal. Price: -2.

• Reward per (un-)loaded game container. Price: +10. Description: Amount which Shipping Line Agent pays to you per container.

• Reward if Other sea-vessel is loaded within 2 days. Price: +10. Description: Bonus for speed.

• Serving Rush Order. Price: -10. Description: Offloading the import container directly from the sea-vessel to the inland transport unit.

• Day at Container Terminal per order. Price: -1. Description: Costs of the container storage per day.

• Hiring extra capacity for serving trucks (5 actions for one day). Price: -2. Description: There are parties which can provide Container Terminal with extra equipment for serving only trucks.
Schematics and Photos.

B.1 Schematic of game Layout

Figure B.1: Player Placement Schematic
B.2 Photos from Tryouts

Figure B.2: Photo: Version 2
Figure B.3: Photo: Version 3, first tryout
Figure B.4: Photo: Version 3, university tryout
Figure B.5: Photo: Version 3, university tryout

Figure B.6: Photo: Version 3, last test before final tryouts
Figure B.7: Photo: Version 3, final university tryout
Figure B.8: Photo: Version 3, final tryout
The lecture slides for the introduction presentation are presented in Figure C.1. Game master is allowed to prepare own slides, however it is recommended to discuss the topics from slides: general explanation of Situational Awareness, link between SA and performances in hinterland transport, reasons for a game. As the final tryout showed, players can experience disinterest to the topics of the presentation at the beginning what leads to the absence of the input for the discussion. Game master is advised to do the background check of the players and derive several questions relevant for the players questions which should be asked before the presentation and again after the presentation.
Interview questions

D.1 Danser

Interview with Cees Korporaal: Operations Manager atDanser.
Question: What do you do?
Cees: Since 2004 I work here, I began as a planner for ships. In 2007 my manager left, I was promoted to this position, manager of the planning department.
Question: And your daily activities are?
Cees: We have a line service in Basel for de Penta, cooperation between Danser and SNFR. I have to monitor the shipping scheme of the our ships. If we have more cargo, I have to find a ship. Of course, I investigate whether we can optimize the shipping scheme, also the occupancy of the ships. General planning: if we have at some day many cargo’s, I search for ships in the market which can transport these containers. On the other side, if the ships are empty, it is my responsibility to find more cargo. But mainly I am concerned with problem solving. If there is a problem and the planners cannot find the way out, they come to me and I have to figure it out. I am also in the management team, which consists out of 5 members. I also concerned with execution of the project like AEO certificate. In Antwerp they are busy with BTS, this is program where ships are signed in when they arrive to the terminal and the time of the arrival is automatically feed-backed to us. The last project I did was TICS, it concerned innovative ideas in the supply chain.
Question: Who are your clients?
Cees: We have different clients: of course the shipping companies, expediters. These are two most important groups. Sometimes the terminal wants to transport the container, but it happens not that often. However the biggest clients are the shipping companies.
Question: It is slightly differently explained in the literature, which tells that nowadays the power of the shipping companies in the inland transportation is shifted to the forwarders.
Cees: The thing is, we are here in The Netherlands where all the big shipping companies are present, this is the reason why we are more often dealing with them, but if you look at the Switzerland, there are more forwarders and expediters, far away from the big shipping companies.
Question: So there is an email or call from Maersk, and they say that they have containers to transport for you.
Cees: We have regular customers, they send an email or they call us, this is handle by the department Customer service. They say that they have for example five containers from Maasvlakte to Strasbourg, and asks us whether we can you do it. The customer Service searches the ship in timetable. And they response, for example, that next week Tuesday we can load the containers. The customer agrees. Customer services books them in the system. They send the electronic message to the planning, and we plan these containers.
Question: How many days before the desired load day from the terminal, does this email or phone call happen? Week, month, days?
Cees: Week or two in advance. You can make a distinction, whether it is a full container or empty. Full container comes from example from China. The client knows several weeks
upfront the arrival time to the ECT Delta. The full container are booked earlier than empty containers. The client knows that in two weeks the container will be in Rotterdam and it has to go to Strasbourg. They can already book us.

**Question:** Does it happen that the booking is canceled?

**Cees:** Yes. It happens from both side. The client can say that he needs it earlier in Strasbourg. Let assume that the container arrives at Rotterdam on Thursday, we say that we can load him only next week Wednesday.

**Question:** What if the booking is already made, but after a week, the client cancels the booking?

**Cees:** It happens, but not that often. You only have to provide to the client correct and honest information at the moment of booking. If our offer does not suit him, we try to find other solution. If it does not work out at all, we have to say "no" to him. So in this case the clients has to find his way out, like for example the train.

**Question:** How many terminal calls do you make during a visit to Rotterdam?

**Cees:** Somewhere between 7 and 10 for us.

**Question:** It is probably a nightmare to book the berth time so that it suits you.

**Cees:** Yes, correct. It is quite difficult. You want to get a time that suits us. We do not have fixed number of containers per terminal, let say 50. In the reality, for one container terminal we have 10 containers, for other 40, at the third one only 2. There is a big difference per terminal.

**Question:** How do you book the visit to Rotterdam?

**Cees:** We are going to load the container from Rotterdam. We have certain data, we requesting the visit, and we get the confirmation back. One day before the visit, we send a load list to them. We have received all data from the client. We send to the container terminal that we are coming to load these container to the inland ship during this confirmed terminal call. Terminal responses by saying that some container do not have documents, this container is not free from The Customs. These are the reasons because of which the container are not allowed to be loaded to our ship.

**Question:** These things has to be in order one day before?

**Cees:** We get the response immediately after we sent the loading list. In general if these things are fixed meanwhile, the container still can be loaded. We go to the client and tell him what is wrong. If the clients manages to fix it before the arrival of the ship, we still can load his container. If we take a look at ECT terminal. ECT said: you send your loading list, but we do not check it, it is up to you that all the containers in the loading list are correct. All the containers, about which the data is yet missing, they do not give any feedback to us. What we can do, we can check at the website whether everything is ok with these containers. They say that we do not check it anymore, the department does not exist anymore which controls it. But now, you can do it on the website.

**Question:** Did they give a software tool to do that? Or you have to do it container by container?

**Cees:** Yes, we have a tool for it. So we do this control here. Before we send the loading list, we perform the check, we inform the client about missing documents or that the container is at scan, and we hope that it will be fixed. After that we send the loading list to ECT. Actually the same holds for Euromax, it is a part of ECT. This is how the ECT works. If you look at the APM terminal, they give a response if something is not correct. This is how the import containers are booked. For export containers we load the container is Basel, we unload it in Rotterdam. We send the discharge list to the terminal one day in advance before the estimated arrival time. In the discharge container number, sea ship
name, discharge reference, end destination are mentioned. At the ECT, they say again that they are not interested in the control. So we control whether the discharge reference is known at the terminal. If it is not we inform the client and ask whether we can get new one, or you did not registered the container at the terminal. It happened several times that we informed the client but the client did not fix it, so I had been woken up by the captain that the container was not being unloaded. And then I call the ECT to clear this situation up. ECT says that there is no lost reference, so it cannot be unloaded. Other terminals inform us whether there is a missing reference, so that we can ask the client to fix it.

**Question:** Do they control the discharge references during the unloading?

**Cees:** The unload only the containers with known discharge references. The rest is our problem. Other terminals, what smaller terminals, they control it as well. For ECT, which is large, it is quite problematic to check it. They have a lot of power, they can dictate to us.

**Question:** Actually they have pushed their responsibility to you?

**Cees:** Yes, actually as well. They push us to use electronic loading and discharge lists. However, the information exchange within the chain improves.

**Question:** Do you experience problems during booking of the berth time? You are not the clients of the terminals, so they are not interested in satisfying you.

**Cees:** We are dependable on the terminal, whether they have place for us. At the other side, we have the containers which belong to their clients. But if the sea vessels have to wait for the terminal to accept him, the shipping company charges the terminal. We cannot do it. With the terminals where the berth time is booked electronically via Portbase, you can only hope that the berth time you get is convenient for you.

**Question:** What if the time does not suit you at all? What do you do? Do you call them?

**Cees:** Yes, we call them. most of the time it can be fixed to some extent. Yesterday in a specialized journal there was an note that ECT is experiencing big delays this week. I saw that the ship that we registered for Wednesday evening, received the berth time for Friday afternoon.

**Question:** And he will be waiting there?

**Cees:** I am still thinking about that. I have to monitor the shipping tables of our ship, and the ship has to be on time in Strasbourg and in Basel. And after that again to Rotterdam. It depends on to what extent I can translate the delays of ECT to our other clients.

**Question:** And with the smaller terminals, this process is less problematic?

**Cees:** Yes, you can call them, you can talk to them. The booking is mostly done by telephone. APM not, sometimes you have to wait for them for three days. And several times in the year they have these delays, that two large sea vessels come at the same time because of the fog or storm.

**Question:** And if your ships are running late? Do you inform the terminals about that?

**Cees:** Yes, in principle, the day before the ship is in the Rotterdam, we submit the discharge and loading list together with the timing. And during that day, the captain contacts the terminal. We made a planning, but each time it is different. If the terminal has the one hour delay, the shipper calls other terminals and he can visit other terminal during this hour.

**Question:** Thus, you are quite flexible with it, aren’t you?

**Cees:** Yes, we told to the captains that they have to find the way out to unload all the container, if of course it is possible. We know that it is not always the case. But they have to be as flexible as possible.

**Question:** And what happens if the container is already on the ship. And the berth time that you receive from the terminal is only after several days. What do you do then with
the container that has to be unloaded at this terminal?

**Cees:** It is happened just yesterday. The ship which had to unload 30 containers at ECT delta, it had unloaded all the containers for other terminals in Rotterdam except those which are for the ECT delta terminal. And the berth time he got from the terminal was only for today's evening. But this ship must be also unloaded in the Antwerp, where the containers had to catch sea vessels. And we said? What are we going to do? Are we going to wait for ECT 24 hours, so that containers of our clients would miss the sea vessels, because of the ECT. We decided that we will look at the ship, how many container it has to move to be able to unload all the containers in Antwerp. The captain said, that he needed to move 10 containers. This is 10 container times 40 euro for moving costs is 400 euro. But in this case all the containers are on time for the sea vessels in Antwerp. And with ECT, we will see when these containers can be unloaded at ECT.

**Question:** These container stay on the ship?

**Cees:** Yes, they stay on the ship. I could unload them somewhere else in Rotterdam. But this will cost us something, maybe, 25 euro to unload the container, times 10 containers. Also we have to load them again, 25*10 = 250. And if we want to ship them again to ECT, it costs 20*10, thus 700 in total.

**Question:** Do you pay all these costs by yourself?

**Cees:** We manage it by using other ships from other departments, but still we have to pay them. The question is, what I would do if ECT gave the time not in the tonight but today in the morning. What would I do. I do not know actually. In such case it becomes more difficult. The delays become lesser, so would I wait or not? With unloading tonight is quite obvious decision due to long delays.

**Question:** What kind of information do you receive from your client about the containers?

**Cees:** They give how many, the type of the containers, the weight, documents, where to load it, when it is going to be free to load, where it has to go, end address, do we have to organize the last mile trucking, if there is a pin code given to the container, the inform us about the code too, from which sea vessel it comes.

**Question:** What do you miss?

**Cees:** The PIN code is not always send together with the booking. The container arrives to the Rotterdam. The shipping line says you can pick it up from the terminal with this PIN code. So we have to go back to the client and ask him what the pin-code is. Sometimes we have to check which customs document it is. For example the goods to Switzerland are always transported with T1 because Switzerland is outside of EU. But the containers to France. It can be that they are already imported and we get EMA. But it also possible that the client wants to import it in the France and not at Rotterdam, then we need T1. This is information that I notice that we miss quite often.

**Question:** And if you miss it, you have to get this information from you client.

**Cees:** Yes, ideally it would be that we have online booking form, and the client has to fill it completely in. But they say that they have their own system and take what we have there. I know at some railroad transport company they ask all the clients to fill in online form, otherwise they will not perform the transportation.

**Question:** But can they do it with big parties like Maersk?

**Cees:** I do not know who their clients are. But of course it depends on the size of the client. You have to adjust your business processes if you work with giants.

**Question:** And the problems that your mention regarding the missing information, with which type of clients does it happen more often? Shipping lines or the expediters?

**Cees:** Both, but in percentage the expeditor’s are one more extra party in the chain where
the information can get stuck.

**Question:** How do you arrange door-to-door transportation?

**Cees:** The client gives us the order to transport the container to the factory somewhere near Freiburg. We receive all the information about the end destination. We search where it is, look for the most appropriate terminal to unload it. We get back to the client and say how much it costs to transport to this terminal and the last mile is going to cost you that much. The clients agrees with that, the customer service department does it. They book the container in the system, give us, the planners the order to transport it by barge. And they search the transporter for the last mile.

**Question:** And these are the regular partners?

**Cees:** Yes, we work always with the known parties. So we call the trucker that we need the last mile transportation for the container that comes to Strasbourg on this day. He plans it, he says when he can pick it up. If it suits us we agree. When the container is in Strasbourg the trucker picks it up?

**Question:** And does it go wrong?

**Cees:** Yes it goes wrong. Imagine, that it is been a while since the planning was executed. The ship can have a delay. So that it is one day latter in Strasbourg. So you have to negotiate with the trucker whether he can pick it up one day latter, and also with the client.

**Question:** And you are thus responsible for this container from point A to B?

**Cees:** We are responsible for the transport. That it is on time. For example if suddenly the trucker says that he cannot perform this transportation. We have to find other solution. We pay for the unloading at Strasbourg, for the trucker, sometimes the trucker has to wait for several hours at the end destination to be unloaded, we also pay for that. Sometimes the client wants to import the container at Strasbourg, we can arrange it. But in this case the Customs comes into play, which can suddenly ask for the scan.

**Question:** And you call the trucker to inform about the delay due to the customs.

**Cees:** We inform the trucker about it, he waits there for several hours and we pay for it. Of course we say charge this costs to client because it is his container, and they could know what is inside and the customs can be interested in it.

**Question:** Do you know how the rail service of Danser is managed?

**Cees:** The rail service is sold by us, and we book by EGS the part of ECT. The client comes to us with the container which has to be transported from Rotterdam to Munich and asks when we can do it. We ask EGS whether it can be transported with next train (the time tables are known). EGS responses to us, and if it can be transported, we send information about the container to them. If something goes wrong it is fun to find out where it goes miss. If there is no document which the client wanted to make by himself, then we charges him for the made costs. If the ECT did not load the container to the train because they forgot or something. So the client comes to us with charges about extra costs made, we charge the ECT for it.

**Question:** Do you receive, accept rush orders?

**Cees:** Yes

**Question:** I heard that container terminals are less flexible. Probably the inland terminals are quite ok from this perspectives?

**Cees:** Yes, indeed. Small terminals are indeed flexible. But with bigger terminals it is difficult. There are busy with their processes. If I ask ECT 12 hours before the arrival time if they can add one more container to our ship, at this point they are already started with the processing our order, so they say NO. At APM it is easier, it can be done. At the
smaller terminals, and Antwerp it works always. In the former they look differently at the problem. But ECT all the logistic processes are aligned with each other. One of the reasons is the order is processed by different number of departments. For rush order I probably call when the containers are already visited the Customs and at that particular point they are already being transported towards the berth. This is ECT, it is almost always something to arrange at other terminals.

**Question:** Can we go back to the shared situational awareness? Does Danser know what at the container terminal happen, what kind of problems they experience, what is your influence on them.

**Cees:** I know, that they want to have information from us in time

**Question:** But do you know for which of their processes this it is important?

**Cees:** I know what kind of information they need from us. I understand why they need this information. They have to know where they have to transport container from our barge or to our barge, which sea-vessel it is, the size of the container. All this is on our discharge list. But how it is processed within the terminal, I do not know.

**Question:** What if your client have booked you three weeks upfront before the arrival of the sea-vessel. When do you declare this container at the container terminal?

**Cees:** One day upfront. ECT is the most simple, they ask it 24 hours before the barge arrival. But if we declare it at ECT one week upfront, we do not have the planning for the barge. We do not know yet when we will come, exact timing we do not know.

**Question:** Till 24 hour the container is somewhere in the general stack? So that if the trucker comes and says I am picking it up, it is still possible?

**Cees:** Yes. It happens actually. The client first books us, but at some point he decides that he needs it earlier and says that the container is going to be picked by the truck.

**Question:** This is actually what the terminal does not want. They would like to filter the containers in stack according to the following transportation method and the time of picking up.

**Cees:** Yes. In the principle the client knows what the next transportation mode is going to be. (...) I understand that terminal wants to know timely how and when the container leaves the terminal.

**Question:** Do you have a sensitive information that you are not keen to share?

We do not share the selling prices.

**Question:** And qua planning, arrival time of the barges, which containers.

**Cees:** Not really. We transport goods, that’s it! However we transport sometimes the things like cigarettes whose transportation is constantly monitored with GPS signals and light sensors, the time at the terminal is constantly measured. The container are always on top of other containers. So that if there is some deviation they can check it. But when it is on-board, they are loaded somewhere on the ship. At this point they lose them. Nobody knows where they are on-board The captain makes the vessel-plan. And they hope that they can find him in Antwerp. On board nothing happens with the container. If something happens, it happens at the terminal. This is probably an example of the sensitive information which terminal would like to know. But I do not think that we have the sensitive information that we do not want to share with terminal.

**Question:** And if something happens with the container on board: there is smoke coming out, something is leaking, etc. what does the captain do, or the person who notices it?

**Cees:** We have procedures for this kind of situations. The captain notifies the planner, makes a photo, declares the damage. Planning contacts the client with the photo and the information from the shipper. The clients is then informed. What does the clients do with
this information? Notifying the insurance company, or maybe he decides to change the
destination and discharge at somewhere else.

**Question:** If he says no problem, just continue. Do you notify the terminal?

**Cees:** No, we do not do that. This is information that the client has to forward to the
terminal, but we do not do it.

**Question:** And the reason for not notifying is that it was never asked from you?

**Cees:** Yes, because it is never asked from us. While it is actually a quite good one. Last
week we boarded on board the container with the damage, there was a hole in the container.
The captain noticed that. But why did the ECT not inform us? Did they not see it? Why
did the client not inform us? In this cases we inform the client and sometimes he says
that he already knew that. In principle we have the same thing with the cooled containers.
Sometimes it breaks somewhere halfway, but we do not inform the terminal, only the client.
We assume that the client informs the container terminal that this container has to be
placed in the separate stack, because it has to be controlled and repaired. What I always
ask myself, how many points are in the chain. If we the barge terminal, we going to pick up
the container from the terminal, we declare it at the container terminal. But the discharge
reference is unknown. So we ask our client. But our client is not always the owner of the
container. He is booked by the other expediter, which is booked by the shipping line. So
there is at least half day one day before we get the discharge reference. The guy with
whom we are working knows why it is, but probably the guy which booked us deals most of
the time with something else, so he does not know that. The half of important information
can be filtered out by him. It is so important that all parties in the chain know why and
what kind of information is needed. As in the example with the damage. We declare the
damage to the client, client declares it to the shipping line. Shipping line give an order to
the container terminal to store the container separately. But at the same time we declare
the discharge list where stated that nothing is wrong.

**Question:** And in general. Do you miss some kind of information from one of the parties
you are working with?

**Cees:** Not really.

**Question:** Do you need a certification from the government?

**Cees:** We have all kind of the permits such as dangerous goods. As a company we have a
AEO Customs certificate that we are trustworthy.

**Question:** Does the client asks whether you have the permits or not?
The AEO Customs permit, there are clients who require that. So some of the clients
required us to obtain this certificate. We did it, and then some of clients asks the number
of our certificate. ECT Delta terminal has it, we do as well. The next step is actually
to require our the truckers which we book for door-to-door transportation to obtain this
certificate, so that the whole chain becomes trustworthy

**Question:** If you transport the dangerous goods, do you require the last-mile transpor-
tation providers to show you the certificate.

**Cees:** We have indeed dangerous goods. So we ship it from Rotterdam to Basel. We
receiver from the clients Dangerous Goods Declaration. We send it to the ship.

**Question:** But do you ask the truckers whether they have it?

**Cees:** No, not really all of them have that. We only notify that there is a dangerous goods
in the container. All the truckers have all these kind of certificates.

**Question:** But you do not explicitly ask whether he has that or not?

**Cees:** We do not ask it, but we declare that there dangerous goods.
Email Questions:

**Question:** Hoeveel dagen voor de transportmaakt de klant een boeking? Weet u waarom de klant dit interval kiest? **Cees:** Dit kan heel verschillend zijn, als we hier een verschil maken tussen IMPORT (Rotterdam naar Hinterland) en EXPORT (Hinterland naar Rotterdam):

Import: Beladen containers worden in een periode van 1-3 weken vooraf geboekt, containers zijn onderweg met een zeeschip en daardoor is goed te bepalen voor een klant wanneer/hoeveel containers er aan zullen komen in de zeehaven voor het achterland. Lege containers worden nog tot de dag voor belading aangevraagd (dit heeft te maken met de vraag naar exportlading).

Export: Dit is meer een last-minute markt, waar containers voornamelijk in de laatste week geboekt worden, klanten kunnen er dan voor kiezen of containers nog met een bepaald zeeschip meekunnen vanuit de zeehaven.

**Question:** Geeft de klant altijd alle nodige informatie tijdens de boeking mee (PIN codes, Douane documenten, shipping line vrijstelling nummer, ezv.)? Als niet, wat missen jullie het meest en zijn u op de hoogte waarom het zo gaat?

**Cees:** IMPORT: Niet alle klanten sturen direct alle gegevens mee, douane documenten/pin-codes worden vrijwel nooit met de eerste boeking meegestuurd. Reden hierachter is dat import-containers betreft die nog niet in Rotterdam zijn aangekomen, de rederij heeft ze dan ook nog niet vrijgesteld (geen pincode) ivm betalingen / zekerheid ezv. Hoe meer schakels in de keten, hoe slechter de informatievoorziening is, bij klanten die expediteur zijn, gaat al informatie verloren.

**Question:** Als het wordt besloten om een terminal niet te bezoeken (bijvoorbeeld omdat het gekregen berth time van de terminal 3 dagen later is dan verwacht), wie wordt er op de hoogte gesteld? Weet u wat de consequenties zijn voor de container terminal en uw klant?

**Cees:** In dit geval wordt zowel de betreffende terminal genformeerd en uiteraard de klant. Consequentie voor de klant is in dit geval extra kosten (detention/demurrage), voor de barge-operator gaan er TEU-plaatsen (inkomsten) verloren op het schip. Het is altijd een kostenafweging of containers dan eventueel ergens anders gelost worden of dat er toch gewacht wordt.

**Question:** Controleert u het gewicht van de container? Als het niet klopt met gedeclareerde gewicht, wie wordt er op de hoogte gesteld?

**Cees:** Gewichten worden niet door ons gecontroleerd, een schipper merkt aan het schip als gewichten niet kloppen, en zoekt dan uit welke containers zwaarder/lichter zijn dan opgegeven. Als een schip hierdoor in problemen komt ivm diepgang/stabiliteit, blijven de containers staan en wordt de klant genformeerd.

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**D.2 Dubbelman Container Transport**

Interview with Arjo van Driel, planner at Dubbelman Container Transport.

**Question:** What does the Dubbelman Container line do?

**Arjo:** We transport containers from sea port Rotterdam to Birsfelden., with all possible stops in between.

**Question:** Who is your client?

**Arjo:** Mostly, our clients are the sea shipping lines, for example Maersk is our client. They
transport their container via APM terminal to Basel.

**Question:** Thus, the clients are not forwarders.

**Arjo:** It happens, small percentage of clients are the forwarders.

**Question:** What kind of information is given to your by the shipping line during the booking?

**Arjo:** In principle, to transport a container the following aspects are important for us: the size of the container, the weight. And there are some requirements from the government but this is only what we need. We transport literally from A to B.

**Question:** Is the time pickup time mentioned in the order?

**Arjo:** Of course, if for example, it is an import container from the sea-vessel, and the client mentions that it comes from Emma Maersk, and client says: ship will be unloaded on Tuesday, When can you load him to your ships?. We can for example on Thursday load this container and then we are in Basel next Thursday. This is how we communicate with each other.

**Question:** I had different idea in mind. I thought that you were more often working with the forwarders. Does the whole industry work in the same way or is it your specialization.

**Arjo:** No, the whole inland shipping looks similar.

**Question:** How do you communicate with the container terminal in PoR?

**Arjo:** We register the barge via PortInfolink. We put a call that we want to load a certain barge at the terminal on the certain day. We have to make this call 48 hours before the arrival time of our barge to the terminal, and 24 hours before the planned arrival time we get the response from the terminal whether the terminal can accept us and on what time.

**Question:** And what if you need to visit several terminal during the same call?

**Arjo:** Here where the problems start, that is what we do the whole day, trying to shift given times from each terminal so that we still can load all the containers from each terminal. You can imagine that if we register via PortInfoLink for APMTerminal, for ECT delta and Euromax, APMTerminal can say, as you asked to load on Thursday morning, you are allowed to load at Thursday morning, at the same time ECT Delta says: it is not possible to load on Thursday morning but Friday is ok, but Euromax says Thursday evening is ok.

**Question:** And what do you do in this kind of situations

**Arjo:** We are romping then. We try to find a solution by talking to the terminals: maybe little bit earlier, little bit later, and so on.

**Question:** And do you succeed in it?

**Arjo:** Yes, normally WE manage to find a solution, not the terminals.

**Question:** And what if you cannot manage to find a solution?

**Arjo:** In this case we cannot load the containers.

**Question:** And what happens after that? Does the vessel wait for the containers?

**Arjo:** No, the barge does not continue waiting. It waits until a certain point. But we have fixed shipping times, and this is made to give our clients an estimation about the arrival time of their containers to the destination, for example in Strasbourg we have to be on Tuesday morning. If you have to be in Strasbourg on Tuesday Morning, it means that the ship has to departure from the PoR on Friday, around 18.00. If, for example, ECT Delta says, that despite that you request a call on Thursday, but we can serve your ship only on Saturday, then our answer is: it does work for us. It is simply because all the containers which are already loaded to the ship from other terminals will arrive to Strasbourg with a delay.

**Question:** And the owner of the containers (or the client) is informed that his containers cannot be loaded on the ship.
Arjo: Yes, we inform the party which has booked this container that we are having the problem.

Question: How do you deal with forwarders?
Arjo: In the exactly the same way. Forwarders are often in the hinterland. For example in Weil, there is client, which asks to transport 5 container to Rotterdam port for certain sea-vessel. And then we transport.

Question: And if something happens during the transport what causes the big delay. How do you inform the rest of the involved parties?
Arjo: By email, and sometimes by phone.

Question: You call (write an email) to for example container terminal?
Arjo: We call everyone who is involved: in case of shipping line as a client, we call them, the terminal is also informed.

Question: But I can imagine the situation when you do not want to inform the container terminal because you have already booked berth-time. In one of the papers I read it was states that sometimes the captain knows, for example, that he is two hours behind the schedule, but he does not inform the terminal, because he does not want to be shifted to other time
Arjo: No, it does not work in that way. If you know that you are late and you do not inform the terminal about that, it does not make any sense. Terminals have very tight planning, and if we for no reason are 12 hours late, then we have a problem because they do not shift their schedule for us.

Question: But are you aware about the processes what happen at the container terminal?
Arjo: We know exactly what there happens. I have worked there, so that is how I know that. But the rest of my colleagues knows it as well. We have been in the company for a long time, almost from the beginning of the containerization.

Question: Do your partners take your problems, your interests into account? Or are they that big that you are negligible small for them?
Arjo: Terminals are not that interested in what we do. For example we put a call for Wednesday morning at Delta or APM terminal, we do not get a call from them that they cannot serve us at Wednesday morning, but that it is going to be Friday. We will be informed about that by email.

Question: And what if something happens at the container terminal: barge crane breaks down as an example?
Arjo: They do not inform us. They inform us that there is going to be a delay. But they do not give a reason.

Question: And if something big happens that everybody is influenced? For example if the barge sinks somewhere?
Arjo: We will be informed somehow, because in this case we cannot perform our activities.

Question: You then inform shipping lines about this problem.
Arjo: Yes. We inform them, and we cannot do anything else. There is no other way. Only thing is that you can do is to try inform everybody.

Question: Do you have a sensitive information which you do not want to share?
Arjo: What kind of sensitive information do you mean? We only transport from A to B and that it is. I can imagine that forwarders do not want to share something with other forwarders, but I believe container terminal do not interested in this kind of information.

Question: Do you have rivals?
Arjo: Yes, of course.

Question: And what are the relationship with them
Arjo: Actually, we have quite good relationship with the rivals. We have good contacts with each other, because we need each other. We book the containers from each other.

Question: If you cannot pick up the container?
Arjo: If we, for example, have the container on the day which does not work well for us, then we call our colleague-rival, asking whether he can perform the transport of this container. And at this point, we are the client at our colleague-rival. And also other way around. But this is not really collaboration, because at this moment you are actually the client for them. We do not share our capacity to them and they do not give their capacity to us. When we give out container away we also do not give any explanation why.

Question: And what if something happens to the container during the transport: captain notices there is a smoke coming out of the containers, or something is leaking? What happens then?
Arjo: We look directly to the papers to check which content it has. This is the first step. If there is something not dangerous, then we inform the client. If there is something dangerous, then the governmental officials are informed and the client.

Question: How often does it happen?
Arjo: Not often. The clients are in general quite long in this business. So they know how to prepare the container.

Question: And if the container is damaged?
Arjo: The client is directly informed, because we are not the owners of the container and we inform the client. We give the explanation how it is happened, what is happened.

Question: Do you have an direct contact with the end client?
Arjo: Sometimes, but mostly not.

Question: Do you know who the end client is?
Arjo: Sometimes, not always

Question: The information you get does not include this, does it?
Arjo: No, it is not important. Mostly we transport from sea container terminal to the inland container terminal. Sometimes in about 10% cases we also arrange the last mile transport. Question: By truck?
Arjo: Yes.

Question: How do you do that?
Arjo: We receive the order from the shipping line to transport the container from Rotterdam to the place near Strasbourg? We say Yes, we load the container at the sea terminal, we ship to the Strasbourg, the truck is already booked by us, and this truck brings the container to the end destination.

Question: What kind of information is given to the transportation company from the last mile?
Arjo: All kind of information, where it goes, the custom status. Sometimes the container comes from specific land which requires special treatment from the customs. So our client has to inform us about that, and we have to provide the trucker with all the relevant information about this.

Question: How do you work with customs? For example, in the situations when the container is not yet imported
Arjo: By APM or ECT delta, there is an automatic system. The client or we make an document in this system, we get an identification number for this container. The customs sees this container and they say whether this container is free to be further transported or not.

Question: And what if you transport the container which is not yet imported. For example
which goes to Russia or Turkey. Does Customs visit your ships?

Arjo: No, Customs never visit our ships. But we transport all kind of the containers, also which are not yet imported. For example the container to Switzerland which is not part of EU. But all the needed documents are done by the client.

Question: Does the client inform you that this container is not yet imported and something can go wrong?

Arjo: No, this kind of information is not provided to us. And if something wrong is with the papers, then the container cannot be even loaded to the ship. In Rotterdam you cannot load the container if there is something wrong with the paperwork, in Antwerp as well. In the principle it is not possible. At the large terminals you have to make an MRN before the container can be transported away. At APM terminal is every container is blocked till the moment when all the paperwork is done. Thus, it is not possible to load the container till the Customs give a permission.

Question: What kind of additional information would you like to receive from the clients, the container terminal, the shipping line?

Arjo: Because we are under the certain time pressure, but the terminals does not feel a need to be flexible for us. If they cannot serve us today, they just shift us to tomorrow, but we lose a day in operations and you can imagine how bad it is for us.

Question: As an example the terminals suffer from lack of information about the next transportation method for the import containers.

Arjo: Yes, I know what kind of problem you are talking about, but we are not involved in it. It can happen that the shipping line books us, but it is up to them to inform the container terminal that these container are going away by barge. So we are not involved in it.

Question: Yes, and sometimes forwarders behave opportunistic trying to find the cheapest next transportation mode. And they let the container wait there until they find it because it is often free warehouse.

Arjo: Not completely true, I hear from clients that the APM terminal start charging from 3 days. The shipping lines have all the information upfront, but they make a decision too late about the next transportation mode.

Question: How do you work the rush orders?

Arjo: We can do that but APM cannot. APM request the registration 48 upfront. You can of course to try do it by phone. But actually it is only possible with the small terminals, which does not work with PortInfoLink, etc. You can call them and say that we have ten containers more, can you load them? But it is very difficult with the big terminals, because there is a big administration layers in between.

Question: My main questions was whether you are aware of the situation at the partners like container terminal.

Arjo: Yes you have to be aware, because otherwise you cannot perform well.

Question: Other way around it does not work, does it?

Arjo: I do not think that APM know how we work. They are not really interested in.

Email questions: Question: Hoeveel terminals bezoeken uw barges in Rotterdamse Haven per keer?

Arjo: +- 16 (en +- 10 in Antwerpen)

Question: Hoeveel dagen voor de transport maakt de klant een boeking? Weet u waarom de klant voor dit interval kiest?

Arjo: Export: Klant maakt de boeking zodra de boeking bij hem binnen komt. Is dus
Mijn klant kan pas bij ons boeken als een fabriek er voor kiest om de boeking bij mijn klant te plaatsen. Een aantal boekingen krijgen wij daardoor weken voor belading maar een flink aantal krijgen wij pas tijdens belading.

Import: Krijgen we in regel ruim op tijd, maar ook niet altijd. Mijn klant is weer afhankelijk van de info die hij krijgt van overzee.

Ook voor lege containers opvarig (worden gebruikt voor export) is het zo dat de ene klant een week tevoren boekt. Maar een aantal klanten weet pas woensdag wat er verscheept moet worden. Dit is weer omdat die klant dan pas de boekingen doorkrijgt van de kantoren in de rederij hoeveel containers er nodig zullen zijn om alle export boekingen te laden. Lege containers afvarig worden meestal 3 4 dagen van tevoren besteld.

**Question:** Geeft de klant altijd alle nodige informatie tijdens de boeking mee (PIN codes, Douane documenten, shipping line vrijstelling nummer, enz.)? Als niet, wat missen jullie het meest en zijn u op de hoogte waarom het zo gaat?

**Arjo:** Tijdens het boeken is de volledige info niet bekend. Pin-code, doks, enz. volgen later. Wij zijn op de hoogte. Overigens is hier ook weer een twee-deling in Import en Export.

**Question:** Als het wordt besloten om een terminal niet te bezoeken (bijvoorbeeld omdat het gekregen berth time van de terminal 3 dagen later is dan gevraagd), weet u wat de consequenties kunnen zijn voor de container terminal en uw klant?

**Arjo:** Ja dat is mij bekend.

**Question:** Controleert u het gewicht van de container? Als het niet klopt met gedeclareerde gewicht, wie wordt er op de hoogte gesteld?

**Arjo:** Wij kunnen het gewicht niet controleren. We hebben geen weegschaal aan boord. m.a.w. Wij zijn afhankelijk wat onze klant ons doorgeeft.

**D.3 Transport Overbeek**

Interview with **Kees** Overbeek: Managing Director at Transport Overbeek.

**Question:** What does Transport Overbeek do? Where is your focus on?

**Kees:** Transport Overbeek performs trucking, thus transport of the containers. You have an import flown and the export flow. The import is from the port to the inland, Europe. What we do is mostly the Benelux, a part of Germany and France. Sometimes we transport further. But we see that the competition to the barges and the trains becomes significant. Concerning trucking, we reduced our operating region to Benelux. We transport mostly from the port of Rotterdam, also large amount of the containers from Antwerp. The same holds for export. Export means that the container is picked up from inland, and transported to the port. This is what we do. We have 30 trucks. We are a family company. Me together with my cousin overtook the company in 2005, but the seniors are still involved in the company business. We also do the container storage, sell and rent, but this is done via other legal entity. These are the other business that we do.

**Question:** Ok. You receive an order from the client. Who are these clients.

**Kees:** Our biggest client is the shipping line, Maersk. Also we work with several expediters, one export the apples, this is quite big client for us. We do not often have the forwarders. We also have barge operators, for which we perform transport. They do a lot by barge, but some container they prefer to transport by truck. So they hire us for this transport. We do...
quite a lot of short-work in the port, from one terminal to another terminal. Further, we transport a lot of reefer containers. The part of the reefer cargo’s, has to be connected to the electricity source. We have special equipment for these kind of orders.

**Question:** What kind of governmental influence do you have? Special licenses?

**Kees:** Recently we renewed our license, we had to show that our credit record is ok.

**Question:** Something special for the logistics? **Kees:** You have to show that you have certain cash reserves. You have to show that you have diploma.

**Question:** Do you have AEO certificate?

**Kees:** No.

**Question:** Do the clients ask for it?

**Kees:** No. I have an idea that the hype about AEO is already declining at this moment. I know several colleagues who have this certificate. But I do not know whether they profit a lot from it. I understand that if every link in the chain has AEO certificate then there would be less controls and the processes would go smoother. But we have never got an request to get it. We would not do it from our own initiative. I do not have an idea that if we got it, it would bring a lot of new customers to us.

**Question:** Are they a lot of the controls during the transportation?

**Kees:** There are some controls. I have an idea that they do it in waves. Sometimes they stay near the Rotterdam and check the weights. In the past, we had problems with that. But now we have extra assers under the trucker (front part). We have three lzr, the long combi trailer, which can transport 3TEU. These are sometimes extra controlled. Last year we had several problems when our trucks were outside Benelux. We had a lot of problems due to small problems. It was in Spain and France. They are really strict there. They control the trucks info 4 weeks back. I have an idea that if you once brake a small rule you have to receive the complement and not be punished for that.

**Question:** Mostly is about the weights?

**Kees:** Yes, the driving time is also controlled. But this is thing where we are most interested in due to the planning issues. But it is also difficult. Last week because of the snow, either terminals were closed or the lines were enormous. The driver could get into the problems because of the driving times. As long as he does not have 9 hour rest, his shift is going up. Thus, if the driver starts in the morning and in the evening he is still waiting in front of the container terminal, he can get into the problems. He can make only 15 shift hours a day. It is a lot. But if you are entering terminal with 13 shift hours, you do not know if you can get out of there on time. Especially if the weather is bad.

**Question:** If the 15 hours are over, what do you do?

**Kees:** He has to find next possible parking spot and rest. And sometimes it can be at the terminal. The terminal is divided into front territory and the terminal itself. Of course you cannot rest on the terminal itself.

**Question:** How are containers are booked, what are the procedures. You have called with the request to transport the container from the Eindhoven to Delta terminal. What do you do?

**Kees:** First, we are called whether there is a place. After that the transport order comes in. All the information in most of the time is declared. But with the export containers, it is often not known where the container comes from. Empty container. It is often decided only at the last moment. The shipping line says where we can pick up the container. For example, we receive an order from the expediter, but he did not receive from the shipping line where he has to pick up the container. He give us information on what time we have to be in Eindhoven, the container needs to be transported to ECT Delta terminal. The
sea-vessel has also its closing time. The container has to be there no later than certain time. But you have to be very happy if the order specifies at which depot it has to be picked up. It is the thing which we receive at the last moment. Eventually, we receives it and we can perform the transport order.

**Question**: Does this info come before the truck is underway or after it?

**Kees**: It is of course before the truck leaves for this container. I am talking about pickup of the empty containers. But minimum it is needed to be present in your system. You want to make planning for the next day in the afternoon. So it must be minimum day before the transportation. It the most of the cases it is there on time. But there are clients which give their orders almost a week upfront. Earlier is better for us. In such case we have an overview of the planning so that we can start doing something. And if needed we can hire other trucks. We would like to have a transport order as soon as possible. But there are a lot of orders, I think almost 50-50, if I had to make the distribution I would say that 3 days before the transportation we have 20% of our work, 2 days 60%, on the last day about 40% of new orders come. Thus, it is quite late. A lot of orders we receive very late.

**Question**: Is it about the last information about the order? Or you are talking about the new orders?

**Kees**: It concerns new orders that they call and request transportation.

**Question**: What is the horizon of your planning? Day? Week?

**Kees**: We make a planning only for the next day. That is almost impossible to do differently. Our truckers make on average almost 2 trips a day. The trips we make become smaller and smaller. The trips for several days are rarely these times, about 10-15 a week, while we make about 50 trips a day.

**Question**: Ok, they call you and say when it has to be picked up and where.

**Kees**: No, mostly they mention the trip specifying the day. Can you do it. The planner asks then what kind of the container it is. It is useful to know, especially with export containers, when you can use import containers for this trips. They want to know to which terminal it has to go and where it has to be delivered. They want to know these things always upfront. The clients come most of the times asking whether we can make a trip from Eindhoven. Extra information comes only when the transport order is sent, in 99% times by email.

**Question**: Is there any difference whether it is a full container or empty?

**Kees**: With the full container, in most of the times client knows all the information. Sometimes he does not know where it has to be brought back. We know in the most of the cases based on the shipping company where we can bring it back.

**Question**: Do you register the incoming container at the container terminal?

**Kees**: We pre-register our arrival from our own system by pushing only one button. The data goes to the terminal. It goes via port base.

**Question**: What data goes to terminal?

**Kees**: The amount keeps decreasing. But it concerns the booking, the shipping line, type of the container. In the case of full container, also the content and the documents.

**Question**: If you register the container, does it has to be registered in the system of the CT?

**Kees**: The release number must be known at CT. But we can pre-register the container, and we get back that the release number is not yet known. But it is being constantly updated. If the release number is received by the CT, then we get in our software that it is in order. In the software we have different aspects for each order and next to each aspect we can see whether it is in order or not.
**Question:** And if you see that for example release number is not yet given, you call the client, do not you?

**Kees:** Yes, we approach the client, the container is not yet received a release number. So that they can arrange it. We can pre-register the container for the import. We can see, for example, that the container is not yet present. And it is constantly updated. However, it happens by ECT, but not yet at each terminal. There are number of terminals, where we have to find ourselves this information on the Internet at their websites. It is of course much more simpler if we can pre-register via our system.

**Question:** If the truck is underway, do you inform the CT about the arrival time?

**Kees:** It happens almost never. In Belgium we have to request the arrival time for the truck arrival. In Rotterdam it is not the case yet.

**Question:** Do they spent a lot of time in the lines?

**Kees:** Yes. This is the problem - the pick time at the terminal. How many hours it is. I have to think about it. Lately, I sat next to someone from APM terminal, and he was proud of that the truckers are served on average within 25 minutes. I found it very low score. I have an idea, that on average it is almost an hour. If you are not lucky, you can wait for 2-3 hours. It is extreme, but it happens. Especially now, with this weather. We had one day snow. We had at least 3 days problems because of the snow. The terminals, they were partly closed, they straw, they do not work. After that they have to get back to work to catch up everything. Of course, they cannot do it immediately, so we wait. But our clients except from us that we will be on schedule the next day after the snow. In case of the snow, our clients understand the delays, but the next day they expect from us to be already on time. We also saw that when the first wave of the crisis came, the terminals had lesser personal. But when the economy improved, the terminals had problems with the personnel, there were not enough men at the terminal to keep up with the economy.

**Question:** How many days/hours before the ship departure you deliver the container?

**Kees:** Most terminals require to deliver the container 24 hours before the sea-vessel arrival. Otherwise you can request late arrival. In most of the cases it can be done. But they become striker with that. For the containers heading to USA, the minimum requirements is that the container has to be at terminal 24 hours before the boat arrival. You cannot be also not too early there. There is a cargo opening. I can understand it. Otherwise they have to make terminals even bigger to store all the containers. Sometimes we get an order, we look in the system of the terminals when the particular sea-vessel arrives, and we say to the client that there is no use to transport now, because the cargo opening is yet closed. It happens that too less attention is paid on this aspect.

**Question:** So you control it.

**Kees:** Yes, we check such things every time. We also look whether the sea-vessel is late or not. It is very important for us, because it has quite big consequences for the planning.

**Question:** What if you do not know the sea-vessel name?

**Kees:** It is then requested from the client.

**Question:** Do you transport sometimes under T1 document?

**Kees:** Everything what goes outside the EU requires a Customs document. So the document should be always be obtained. Right now it is often that we start physical transport and the document is made during the transportation and sent to us, and we submit it to container terminal. Since half year we do it. I do not know how long it exists. But it became easier with the documents. Otherwise you had to have a physic document: driver had to wait till it was fixed. If it was made by us, then the document must be brought to the terminal or the driver had to visit us to pick up the document. It was
relatively easy for us, we are in the Rotterdam. Other companies which are placed inland had a lot of problems with the Customs documentation. But it is improved, so that you can submit it electronically. In some cases you can do it with MRN code, terminal can print this document themselves. It works good.

Question: And now the import containers. The same story, the client calls you and there is a container on the ship.

Kees: Yes, it is often that they ask whether we can deliver the container to Eindhoven. We ask what kind of container it is, where it comes from. It is what planner wants to know immediately. And if we can do this trip, the transport order comes in. So we see on which boat it is, when it arrives to the terminal, and then this order is entered in our system. Order is pre-registered at the terminal, and then we come to pick it up and transport it.

Question: Well, the container has to get a release number from the customs? Something else what has to happen before you can pick it up?

Kees: You always have to receive a PIN code. Pin code is number under which the container is released. We pre-register it too. If there is match between the release number that terminal has and ours, so we can pick it up. The PIN code comes always a little bit later, at the moment that the containers are released, the PIN code is pushed to us.

Question: It is sent by the shipping line?

Kees: Yes. We are lacking of PIN code, we has to request it.

Question: Does it happened that the driver is already waiting at the container terminal, but the container is not yet released?

Kees: Yes. It happens as well, but now less often, because you can pre-register the visit and you can see it. But it happens as well, that the container is not yet released. I think it happens where we do not pre-register the visits. Sometimes that the container is not yet unloaded from the boat. It can happen that the container is released for barge or train, and we cannot get it for the truck. These are always the rush orders which we receive at the last moment, because there is a problem with barge, or the barge is full or the train. The stunt is to get the container to the truck. But there are problems that the next transportation mode of the containers is not yet modified to truck. It happens as well.

Question: When do you pre-register the containers? How many days/hours.

Kees: We pre-register import containers in the afternoon on the day before the transportation. We send everything with one button. And everything what comes on this day, we pre-register as order arrives. Pre-registration for export we do at the moment that the container is loaded to the truck and the truck is underway. Sometimes there is a problem. Our trucks have board computers so that we can see where the truck is. When the truckers is already at the terminal, the driver sometimes calls us and says that he misses some documents for the delivering. We say to him that why you did not tell us that he was already loaded. The drivers think that we see everything. Now you often need a TAR number to come to the terminal. After the pre-registration you receive a number, and with this number you can sign in at the terminal. You have to be quite quick. Especially if it is a short trip. So that you can get a TAR number. Otherwise the drivers wait there for the TAR number.

Question: How long does it take to get a TAR number?

Kees: I think if it is sent from our system, so that we receive it within 15 minutes. For APM terminal you can do it with the mobile phone. It is fast. Within a minute you get it back. But you have to try to arrange everything before the visit, otherwise the driver keeps waiting. Especially, at APM terminal, if you have problems there, then you are pulled out from the line to fix it and then you have to get back to the beginning of the line. It is good
for the truckers which arranged everything they do not have to wait for those who did not do their homework. But we have an idea, we arrange everything in almost all the cases, but if something is wrong we are still out of the line. It stimulates to arrange everything upfront.

**Question**: Is there a difference between big terminals and small ones?

**Kees**: There is a difference between the terminals. By some terminals you are faster served than by others. You can also see when the rush hours are. Also ECT delta is quite busy terminal, but EUROMAX is less busy, so on average it goes faster. They are owned by the same company, so even within the same company there is a difference in the times. EUROMAX was extra sensitive for the disruptions at the beginning. It is more automated, but if the crane is broken, you could be waiting for 4 hours for the container if your container was at this crane. And you could not do anything. Thus, there is a difference per terminal, also how they work: at APM documents are sent electronically, you do not have to get out of the truck. At ECT you often have to get out of the truck to sign up physically at the desk. You can experience long waiting times at the desk during the rush hours. ECT is split into the different part terminals. If the trucker enters the terminal to deliver two containers and to pick up two other containers and all these containers are at the different part-terminals, then the time spent at the terminals increases significantly.

**Question**: Do you have to leave the terminal and then to enter it at other part-terminal?

**Kees**: No, but you still has to go through one part of the terminal to another. Terminals are often split into block groups. In such block only one vehicle can be present. So at some groups there can be the rush hours.

**Question**: Is there difference how the bigger terminals deal with you, Overbeek, than the smaller one’s.

**Kees**: No, it does not make any difference for us. Overbeek has no other status than the rest of the trucks. The bigger companies are not treated differently than we are.

**Question**: But if it is looked from your perspectives? Is there any difference if you bring the container to the smaller or bigger terminal?

**Kees**: No, it does not depend on the size of the terminal, but more how the capacity of the terminal is distributed. I do not think that smaller terminals that are congested, do serve us faster than big terminals which are not congested. For example, at the Uniport, it became quite small terminal, but several years ago some shipping lines forwarded their boats to the Uniport, and they had big congestions, because it was not designed for it. It leaded to very long waiting times for us. But now it is less congested, a lot of shipping companies are moved to Maasvlakte, and now at the Uniport you are served very fast. But it is because they have a little to do and not because they are small.

**Question**: I asked this because, for example, there is a difference for barges. But it is of course other story for you.

**Kees**: Yes, but what we encounter is that when the very big sea-vessels arrive, the more resources are divided to the sea-side, and less to the land side. I have an idea that when 18kTEU arrives, the terminal says that it is our priority and less resources are dedicated for processing us. It comes because we are not the client of the terminal. We bring the containers for somebody else, so we are not the client or partner of the container terminal. For them it is most important to serve the sea-vessels, these are their clients, the shipping lines pay them. And it is better to let the truck wait instead of the sea-vessel. And the shipping lines probably agree with that. Of course, it cannot get extreme, because you will get then a problem so that the quality of the shipping line services goes down because all the trucks are in the lines, and they miss sea-vessels. And it is a game which is constantly
played. I understood that at the APM terminal 2, there would be a split between land-side and sea-side so that the resources cannot be redistributed. I do not know exactly how it works. But with such split, the long lines for the trucks would be only cause by a large amount of trucks and not because of the resources at the terminal are redistributed. But I do not know how it is going to work, we will know it only in 1,5 year. Thus, in each terminal, it is differently. At the ECT Home you can see very long straddle carriers, if you have a good view over the terminal, you can see on which parts of the terminal there are a lot of them and on which not. So sometimes the driver calls and says I am in the line, but there only two straddle carriers serving us. And then we call the terminal and request them whether it is possible to insert more carriers to this part of the terminal.

**Question:** But are they happy when you make such tips?

**Kees:** If we call them? Not always. If you call them too often, then it can have negative consequences.

**Question:** Do you work with barge operators?

**Kees:** We deliver orders for Barge operators. They do a lot by barges, but they still have some destinations which they prefer to do by truck. We have the destination which they do for their clients, which is suited almost 100 km before the barge terminal. Barge sails along this place and then it has to go back by truck. We have now many of such trips which they prefer to outsource to truckers.

**Question:** Thus, barge operator outsources it to you.

**Kees:** Yes.

**Question:** If they have, for example, one container, they do not even want to stop at that terminal.

**Kees:** Yes, probably. It seems to me that sometimes it is more efficient for them to outsource it. We see this trend rising.

**Question:** Do you get extra problems if the barge operator is introduced in the chain as an extra party?

**Kees:** We transport not much by barge, we try to stimulate it. Because it can also be beneficial for us. We tried to deliver containers several times from Hengelo to ECT delta by barge, but the barge had problems and we were almost late for the sea-vessel. Our clients started to call us saying that it is almost the time and the containers are still not at the terminal. Thus, we had problems. But if we operate smart, we can deliver the containers to barge terminals somewhere inland so that they transport it further to inland and we can make a new trip.

**Question:** Do you always perform trips from Antwerp or Rotterdam to somewhere inland or do you serve some routes like from Eindhoven to Venlo terminal?

**Kees:** We do that only from our own initiative. Our client never gives us an order to bring the container to terminal different from Rotterdam or Antwerp.

**Question:** You decide it yourselves what is better for you?

**Kees:** No, we are limited by the sea-vessels, but if it concerns the empty containers, then we try to be creative and ask the shipping line whether it is possible to deliver it to other place like instead of Antwerp to the Rotterdam.

**Question:** What happens if the container is damaged?

**Kees:** It has to be seen first. You have to check at terminal or at depot. Especially when you are picking up empty container, then you have to check the container. If something wrong with the container, it stinks or there is a hole in it, you have to decline this container and request a new one. You have to get sure that you have a good container. Sometimes it can be problematic.

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**Question:** And if it is a full container?
**Kees:** You load it, you walk around it, of course, you cannot see everything, especially inside. If you receive information during the loading that there is a damage, in this case there is no problem.

**Question:** You receive this information from the container terminal.
**Kees:** Yes, container terminal informs us. If you arrive to the clients and it seems that there is hole in the duck and that the goods are got wet. You have to register it in cargo letter, that the goods are damaged because of the damaged container. Sometimes you get a problem when this was not declared at the terminal. It can cause unpleasant situations. I argue that the chance that it is happened during the transportation is very small. We are not fell over, we did not collided to the viaduct. It is very important to register it in the cargo letter. This is a proof of the transition to the next phase in the transport that the goods are delivered.

**Question:** What if the driver notices it during the trip? Does it actually happen?
**Kees:** Not, we do not notice it during the trip. What is also important is that during the loading on the truck, the seals are checked and registered in the documents, it must be also checked at the delivery point the seals are OK. It means that the container is not been opened during the trip, so we could not control whether the cargo was damaged, or that something went wrong with the cargo. Coming back to the damage at the empty containers, it can be very unpleasant situation if the client declines the container. We get into arguments with the shipping line. We have to load the container at the container depot. The container depot has the container from the shipping company there. They have to check them and make clean. After that they assign status Available to them to pick it up. We load the available container. If there is hole in the container, then you have a problem as a transport company. It can be very unpleasant argument. We always say to our drivers that they have to check the container very carefully during the loading. If there is a hole then just decline the container. If there is a dent in the container, and you still can load it, please register that in the documents.

**Question:** If the driver notices that during the loading, then you inform the client?
**Kees:** It happens that we see that the loading truck damages the container during the loading. Then we call the client to tell him what has happened. We register it in the document.

**Question:** Is the container terminal informed by you about such accidents?
**Kees:** Probably by the shipping lines, not by us. It is often so, that if there is a damage on the container, then it has to be delivered back to terminal. It happens often, because they would like to ship it to China, because there are new goods waiting. Sometimes they say to us to bring it to the depot, where they repair it. So deliver address changes. If something is wrong with the reefer containers, then they ask us to deliver it to terminal because it is cheaper to repair there. The good reefers go to the depot somewhere here. But broken reefers go to China and are repaired there.

**Question:** We partially touched the outsourcing.
**Kees:** Outsourcing is giving the orders to charters? Yes, we do not have fixed charters, but if we have too much work, we ask some of them to drive for us. In some cases, we outsource to the barge operators.

**Question:** Does it happen that you are booked by other trucking company?
**Kees:** Yes, it happens as well.

**Question:** It like trips exchange?
**Kees:** Yes. **Question:** Do you experience then additional problems compared to normal
Kees: It is not that different for us than if we got it from the client. However, we have shipping line as a client which has all the information. But some of them send all the details during the order, some of them not everything. It is better to get a order from the transport company than from the forwarder or end-customer, because they are not aware about the physical transportation. Transport companies know what kind of information is needed for you, and that you have to get it on time.

Question: My thesis is about SSA, so as I understood you are aware what happens at the container terminal, but does the rest of your planners know that?

Kees: Our planners know it quite well. They know where you submit documents, how you do that. They know that you have to be very precise when you arrive to Antwerp, that you have to have a TAR number in Rotterdam, that it is beneficial to check when the sea-vessel arrives at the website. This understanding has a lot of value for the transport company, we have a lot problems if something is missing. However, our clients does not know a lot of this and are not ready to pay for all the waiting times.

Question: Do you have a feeling that the container terminal or your clients know how the trucking company operates, what kind of information is important for you?

Kees: What very important is, they inform us that they are shutting down due to straws. I like it, it is very unpleasant but it is good to know upfront. We had once a strike. But it is good to be informed. The feedback that they give us via pre-registering is very important, and that it is constantly updated, if the status is changed. Sometimes Customs want to check the container, we also get this information, I think it goes via shipping line, but terminal give us the feedback. So that we can see in our system that the container is blocked by the Customs. It works fine. We would like to know more about the rush hours, when they expect a lot of trucks coming in. That would be very helpful. There is an project which is called Dynamic Planning. They will come to us next week and examine how we work, and they would like to examine whether the pick times can be predicted. Can the transport companies to inform the CT a little bit earlier about the visit to Rotterdam. The containers which come after 5 pm are more difficult to pre-register at the terminal because if something is wrong, we cannot reach the shipping line, because they are already closed. We work from 6am to 9pm.

Question: Do you have sensitive information?

Kees: The container content. It is quite dangerous, all kind of high valued cargo’s. You do not want that other parties know that.

Question: Is it requested by someone else?

Kees: We would like to know it to take this into account during planning. If something is very valuable, we do not want to transport in the night. We pick up it in the morning. We would like to know it, because the trucker is quite vulnerable during the stops, they can just open the container during the stop or just kick out the trucker. Also we would like to know about the weights of the container.

Question: Where do you check the weights?

Kees: No, we need to receive this information from the client, also what is inside of the full container. We have extra asses but if it is not needed you do not want to use, for that you have to know the weight of the container. We have lcvs trucks, but still we need to know when we have to put them.

Question: Can it happen that the weight is wrongly declared?

Kees: Yes, it happens sometimes, then you have a problem. In such case, we split the cargo, or let the other truck go. We would like to avoid these problems, because it costs
us money. We would like to make the right combinations between the containers and the resources we put into transportation.

**Question:** Does the container terminal have problem with the wrongly declared weights

**Kees:** The terminals weight all the containers in the crane. But they would like to have an indication about the weights upfront. You have to inform them during the pre-registration. Also they would like to know about the temperatures. They ask the driver for it, because he is the one who has this info on his cargo letter. Other sensitive information is dangerous goods cargo. There was a hype too due to anti-terrorism programs. We have to instruct the drivers in case of some certain dangerous goods. Once we wrote the procedures that the drivers has to follow with this goods. But we do not often see these goods.

**Question:** Do you transport sometimes cigarettes, or other goods where the excise are applicable. I heard that there some kind of gps boxes on the container.

**Kees:** Yes, we transport sometimes the alcohol. Not on the container I think. They have been busy tracing them. I think in the container. But we can trace our trucks. If you have a container with alcohol then we are quite cautious with this container.

**Question:** Do you also pick it up in the morning?

**Kees:** Yes

**Question:** Do you miss some kind of information.

**Kees:** I do not think so.

**Email questions:**

**Question:** Bent u op de hoogte waarom uw klant u zo laat boekt?

**Kees:** Heb ik zelf eigenlijk nooit letterlijk gevraagd, maar hierbij wat ideen van mij:

- Rederijen gaan eerst kijken of het per barge of rail kan voordat ze truck boeken;
- Klanten van rederijen roepen af als ze hun planning rond hebben;
- Boten vertragen soms.

**Question:** Krijgt u een boeking voordat de container is vrijgesteld door de Douane en shipping line? Als ja, wat doet u als de vrijstelling er nog niet is op de dag van het transport

**Kees:** Er zijn opdrachtgevers die pas een boeking sturen als inderdaad verder alles rond is. Komt echter ook voor dat boeking eerder is doorgegeven. Kan dan tot problemen leiden, maar via voormelden of checken op web site van terminal kunnen we checken of dan alles in orde is, en zo niet dan kunnen we actie ondernemen.

**Question:** Bent u op de hoogte de consequenties van uw planning op andere partijen (bijvoorbeeld: ochtend of avond transport)

**Kees:** Planning wordt ons meestal opgelegd door de bestelde tijden. Wij proberen dat nog wel eens te verschuiven, wat verrassend genoeg vaak lukt. Meestal is dit dus geen probleem en als het wel zo is, dan geven ze het aan. Consequenties voor bijvoorbeeld terminals (pieken) worden wij vaak mee geconfronteerd door wachttijden.

**Question:** Geeft de klant altijd alle nodige informatie tijdens de boeking mee (PIN codes, Douane documenten, shipping line vrijstelling nummer, enz)? Als niet, wat missen jullie het meest en zijn u op de hoogte waarom het zo gaat?

**Kees:** Meestal dat ontbreekt is dat bij export nog niet bekend is waar de lege container vandaan komt. Dit wordt vaak pas laat doorgegeven, omdat de rederijen zo lang mogelijk wachten (i.v.m. de planning van hun voorraad/ stock containers).
D.4  Delta Shipping Line

Interview with Stephan Scheurwater: Transport Planner at Delta Shipping Line.

Stephan: Should we start with my education. I studied Transport and Logistics in Jan Backx, MBO. After that I went to HBO, but I did not finish it. So I started working. I began in Zieglers, expediter, specialized in road transport. After that to the container ships, shipping line with the container transport to Finland, Lithuania, Latvia, Russia, Turkey and other countries. And after that I started working here. This company is Russian Shipping Line. The owner is Russian. We ship from Europe to Russia. This is what we do. The most of the clients are Russians. 90% of the bookings come from Russia, and they are forwarded to us, because we are here in the Netherlands and Germany, France, Belgium, and Switzerland are quite close to us. We organize everything with the land transport.

Question: What are your tasks?

Stephan: My tasks are: arrange everything regarding the transport. The Russians send a booking to load two containers in Paris. Before that the price is given to them. They sent us the booking. We make a contact the shipper, make an loading appointment. Then we give this transport order to the transporter. We already know which transport company should be for France, Germany, etc. So we make a loading appointment. We give the transport order to the transport companies, in Belgium it happens one day before the transport, in France 2 days. It also depends on how busy the carriers are. If not we do it one day upfront, if they are busy 2-3 days. In such case they have all info upfront and there are no surprises for them. So this is how we do it. For Russia you need an export documents, sometimes it is made by shipper, sometimes we need to do it by ourselves. We have a customs agent here: we need weights, number of codes. Then Customs agent makes a document. These are the things I do here. ( )

Question: Do you also book barges, trains?

Stephan: Yes, we do it also. But because we are short sea shipping company, there is not that often a use to do it by barge. For example, we get a booking to load on Thursday, I can arrange the barge too, but because barge is slow, we miss two-three vessels departures. The clients does not want that in 90% times. Also we do not have a lot of containers to arrange barge transportation. But we have an agent in Italy, the empty containers are sent from Rotterdam to Italy by train. Over there they are loaded and then they are sent to Rotterdam and from Rotterdam to Russia. Several our clients give us an order several weeks upfront before the desired shipping departure, in such case we can manage barges. It works as well if the order is given several weeks in advance. It happens, but not always.

Question: Thus, this is not my first interview, but as I understand from truckers that they cannot plan in advance because they receive orders only a day before the transportation. Thus, if their client was Delta Shipping, it would not be your fault, but your clients faults, who gives you an order only several days upfront.

Stephan: What I actually do is to try to arrange everything 2 days before the transportation. Of course there are clients which call one day before the transportation.

Question: But If the clients calls you a week before the transportation, do you still postpone the booking of the carrier till this 2 days interval?

Stephan: Yes, and why, because 99 van 100 shippers, give their containers away only if they have received the payment. When I make the appointment with the shipper, he tells me that the payment is not received. So if I book the carrier, but it can happen that the payment is not yet there, so that the truckers has come for nothing there. So this is the reason why we book the physical transportation earlier than two days before the
transportation.

**Question:** Let assume that you need to pick up the container in Paris, then two days upfront you book the carrier. What kind of information you give to the trucker.

**Stephan:** The reference number from our system, loading address, load times, weights (in France and Germany it is not allowed to be higher than 40t), order number. Each container to Russia needs an export document so we notify them whether we make this document or they have to do it. If they have to do it, then the place where it should be done. For temperature controlled containers you need to give temperature data. That is it. Of course the container type.

**Question:** To which terminal they have to go?

**Stephan:** They know it. (...)

**Question:** Do you have to register the containers at the container terminal?

**Stephan:** It happens automatically. If the booking is made, it is in the system of the CT. They know about the booking, it has to be released in the system. But sometimes it goes wrong and the trucker calls us and he says I am at the terminal, but the container is not yet released. In 9 of 10 times, it is solved by calling the CT and requesting CT to release the containers. ()

**Question:** Is it different for the import? Do you receive pin code?

**Stephan:** No we do not do it in our terminal. The release is sent via our system and different papers such customs documents are sent to both terminal and carrier. For the import containers we also want to find the cargo back to the terminal, so that it is not shipped empty to the CT. It costs money. Lets say that about 90% which come from Russia are empty. So the cargo flow is from EU to Russia. (...)

**Question:** But if there is a import container which is not empty. How many days upfront do you book carriers?

**Stephan:** I do not do it by myself. But on average 2 days before the arrival of the container. But it depends on how busy the carriers are. In this period I get calls from the carriers asking whether there is a job for them. In such case I can play around with the carriers. But if everyone is busy, then I can get into the problems for waiting too long with booking. It depends on how busy the carriers are.

**Question:** Do you have AEO certificate?

**Stephan:** No.

**Question:** Is it requested?

**Stephan:** I understood that if you have AEO certificate, that you get less scans at the customs. But I do not know a lot about it.

**Question:** But does it happen that the clients that come to you and demand the AEO certificate?

**Stephan:** I have never had such situation. (...)

**Question:** Do you have a lot problems with customs at the CT.

**Stephan:** The problems can occur. In the past we worked with Uniport, and as already said the containers to Russia has to have the export document. In the terminal it was not problem if the driver did not have the documents upon the arrival to the terminal. The container was unloaded and blocked there at the terminal until the customs documents were made. But at the terminal which we use from January, the carriers are not allowed to get to the terminal without an export document. That can be unpleasant. For example, there is a country wide problems of the customs system. So we cannot make the export document. The terminal in such case says that driver has to wait. It is possible to request an emergency procedure, but in 90% cases the customs says wait for a bit, it will be helped
very shortly. But the carrier is waiting near the terminal. Time costs money.

**Question**: Is any difference between the empty container and full containers.

**Stephan**: One thing is that empty containers has to be checked, the reefer containers has to be checked whether the cooling works. Also they have to be cleaned.

**Question**: And if the ship is running late. Do you inform the carriers?

**Stephan**: The contact is kept with the terminal. Not a lot of delays occur in the short sea.

**Question**: If there are busy times at the CT? They have to wait , don’t they?

**Stephan**: Yes. What else. They get the place where they can wait. Sometimes the wind is too hard so that they shut down the container terminal. Time ago, we had to load at our terminal, then some container has to be loaded from other terminal, and then back to our terminal. When we were at the second terminal it is started to blow hard, so the CT was shut down. So we were late to get to the first terminal back. They said that we missed our slot and our ship could be only served day after tomorrow. We decided to leave the cargo there and we left for Russia. Otherwise the whole schema would be destroyed. Of course there are clients which were not happy with that, but it cannot go smooth every time.

**Question**: Do you know where the container is at each moment during the inland transportation? That he is already picked up, that he is on his way?

**Stephan**: It depends. If, for example, an import container is booked only from the Rotterdam terminal, not really. There is a container controller, which checks when our containers are picked up from the terminal and if the week later it is not yet back, we check what is going on, maybe there are doing business with our containers.

**Question**: And export container?

**Stephan**: The same, unless we arrange pre-transportation till the terminal. We know in this case where they are. We can see whether the containers are late or not for the departure of the see-vessel.

**Question**: And if the container is broken? Or the trucker sees that the container is broken? What happens? Does he call you?

**Stephan**: In most in the cases it is just a small hole or something, we try to fix it maybe at the loading place has the capacity to do it. Or we try to find a company somewhere around which can do repair it. If it big damage, we have to return it to the terminal and repair it here. It can be very unpleasant. Once our container was in France, the hole was noticed. Of course it is responsibility of the carrier to inform us. Especially if you do this work in France, you have to check whether the doors can go close.

**Question**: Do you transport the reefer container?

**Stephan**: Yes.

**Question**: And what if temperature is not in order. The carrier informs you. Do you inform the CT that there are problems.

**Stephan**: In 99 % cases we load in Belgium or in The Netherlands. At the loading place there are no temperature controls. You can only check with the jan fanse. In 9 of the 10 cases, the distance is too small. So you can only see when the container is already at the terminal. Of when they are loaded on the boat. Normally each day, there is someone who checks the temperature. If there is a deviation they report. In such case they send the repairer. On the boat the containers temperature is checked. So if there are problems, at the next port of call the repairer is sent. If it goes to Russia we cannot do a lot. But it is immediately taken care of. it is very important.

**Question**: Do you receive sometimes that the container is damaged, and you have contacted the client which says that it is no problem. And afterwards you get one more report but now from CT.
Stephan: No, I never had that the clients said that it was no problem. I had once a client, whose containers were on the boat, and it was something wrong with the temperature. He said we will manage it in Russia.

Question: What kind of problems do you have?
Stephan: That the payments are not yet received. It happens not that often. And Customs documents. It happens that sometimes that there is a misunderstanding in who has to make the customs document and eventually no one makes it. We have a client from which we always load at 22 pm on Fridays. But several times during the night it was discovered that the Customs systems is not functional and they cannot make a Customs documentation. We cannot deliver the container at our terminal. We deliver it then to other terminals. So it costs again money. And we make the client pay for it because he failed to produce the customs document.

Question: You do not work often with barges. Do you feel a difference between working with barges or truckers?
Stephan: No. previously I worked on the regular basis with BO. And there are not many other problems. The time intervals are much longer. And especially with the short-sea it is quite difficult. Most of the clients are ready to pay more money instead of waiting for barge time.

Question: And now the question about shared situational awareness. Do you know how truckers operate, what kind of planning they have, their problems.
Stephan: Yes, We have two carriers, with whom I work for quit long. One of the carriers has a lot of the import containers. He combines it with our export containers. So he brings own containers to France and brings our containers back. They try to combine that they are full with import container on the way to inland and export containers on the way to container terminal. It brings them the highest incomes. But of course it does not work out always. Sometimes they have lack of the orders, so they call us and ask whether we have orders for them.

Question: Do you know how the container terminal works? I am not sure which CT you use.
Stephan: We use RCT Zuidzijde. It is five minutes from here.

Question: Do you know how they work. I heard how ECY delta works or APM terminals, what about RCT Zuidzijde?
Stephan: I can tell you a little bit. I worked at other shipping line as a water clerk. So I had to go to incoming boats. I begin at the start. The trucker comes to the terminal with full container. He has to have a pass, otherwise he cannot get into the terminal. They have to sign up at the desk and submit the documents. They receive directions where the container has to be unloaded. In most of the cases they have an order to pick up an empty container. They also get the directions to the empty container. And they leave. At the terminal they have planning. The ct work 24 hours, if the boat comes at 1am they start processing it. They have a load plan, the heaviest containers go down, the lighter on the top. (...).

Question: One of the major problems of the container terminals is that they do not have information about the next transportation mode for the import containers. How many days in advance do you inform the container terminal about the arriving ships and the next transportation mode. Or do you not do that at all?
Stephan: I think we do cause this problem to the terminal. We bring only empty container back. If for example there are five full containers on the boat, I do not think that they have problems with them.
Question: But still do you pre-announce the next transportation mode?
Stephan: I do not know actually. I am not busy with it. If I did I would announce it in time. I prefer to give the information as soon as possible. But I do not know about the other colleagues. (...) At the Maasvlakte I can imagine that they have this kind of problems. But this is small terminal, with small boats.

Question: As I see you know how the container terminal works. But does the rest of you colleagues know how the ct works?
Stephan: I cannot say that. Some of us have more interest in that, some less. I personally like to know how the stuff works.

Question: And the last question. Do you have the sensitive information which you would not like to share concerning planning
Stephan: No really. Our competitors maybe would like to know with which carriers we work in case if they are cheaper. But it is not really a secret.

D.5 Karl Gross

Interview with Bart Bom: Planner at Danser.

Question: Can you tell me please about your background, what kind of job you did previously, what your tasks are here in Carl Gross?
Bart: I started at MBO in Rotterdam, I did logistics study, only four years. First I wanted to study further, but I got a very good job offer in New York. I was a freight forwarder there for a year. It was very interesting experience. It was in the port of New York, at the side of New Jersey. It was very good experience, also for myself, before I lived at home. It was little bit more than 10 years ago. From there I worked for the same company in Holland for two more years. Then, I switched to another company, which was focused on the custom brokerage. I worked there for 9 years. Last September, I came to work for Karl Gross. The reason I came here was because this company is smaller. We only have 6 people at the import and export side,. There is a warehouse, here straight on the building. It is very good to see what happens in the warehouse. I was not used to this. I was only custom brokerage, this is what I did previously. Now I am involved in more than just custom brokerage. This is my background and previous experience. What is your next question?

Question: What does Karl gross do, where your offices are.
Bart: The head office is located in Bremen, Germany. We also have four offices in Germany, one in Rotterdam. We are really independently working here. Of course we have contacts with each other. They use our warehouse. But we have own profits, we work really independently. But it is always good to have people on the sight who can help you. Of course we are one company. But it is good choose your own way to deal with problems. That is very good that we are independent.

Question: Do you share the clients
Bart: Yes we do share clients. But most of the clients are either handled here or in other offices. Of course it depends on the type of client. If it is a Dutch client, then we handle him here.

Question: Can you explain to us your typical operations, what you offer to the clients, how the clients contact you. Lets say the goods are being transported from A to B, what is your role.
Bart: I think what typically is for the freight forwarder, we represent the client. So we pay
the local charges to the shipping line. We take care that containers are released by Customs and that shipping line takes care of the release. From the terminal, we pick up the container and bring it to the client. And if they want we can unload it here and do something else with it here, whatever they want. So it is typically what the freight forwarder does plus that we do warehousing.

**Question:** Do you own trucks?

**Bart:** We do not trucks our self. We work closely with the local container truck container. They bring empty container here and bring full container to the terminal and other way around. That is really for local movements here, for movements from terminal to warehouse. We use different trucking companies, based on the destination of the goods within Europe. So we do not own the physical transport. We use other services from different companies.

**Question:** Do you also use barges, trains?

**Bart:** Yes, sometimes, but not a lot.

**Question:** Is there any reason for that?

**Bart:** My clients are located within Holland or Germany. I have a lot of clients that unload the cargo’s in the warehouse so the cargo becomes small shipment. So it is small shipment, what you do not normally transport by barge. At my previous job I worked for the company in Hengelo, they had many barges, almost everything was transported by barges. It happens a lot, but not with my clients. Our clients are not so big, so the profit by switching to the barge is small. And it takes longer, and the prices of course are lower, but not that lower. If you only transport three containers a month, the difference is not that big. If you transport 100 containers a month, the difference becomes significant. I do not have a lot of business with barge operators at the moment.

**Question:** This is because the clients are relatively small?

**Bart:** Yes, because they are small. Of course it does happen that it is a best option for certain transport. You never know what the wishes are of a new client. But we check the possibilities.

**Question:** Can you explain us how the orders are processed within the company? So the client calls you and says that he has two containers.

**Bart:** If it is a new clients, than we start with offer. We ask him what he needs, what he wants. We ask him a question to make sure that we can give him a correct offer with everything involved. Then we make a offer, what is usually done by our sales department. I can do it too if it concerns only a transport from A to B, I know who to call and how to request the rates. I can do it within a hour. If it is a new clients with the full transport from China to here with the haulage in china and here, it is usually done by our sales department. They make a good offer for the client. If they book it, we see what the options are. We call different shipping lines, check with our agent, sometimes with our own colleagues in China what kind of shipping they can book and transit times, whatever it is needed for the client. If they book it, we make sure that the shipper, the company where the goods are loaded in China, that they are aware of it, and make the appointments. The biggest part of it I can outsource to our agents or colleagues. And then to wait for the vessel to arrive and, of course, to keep the client informed about the arrival. When it is a new client, usually we ask to pay upfront. These days sometimes it is really hard to get your money back. When it arrives, I take care of the custom clearance. This is what we can do in our own system. We make sure that the containers are released by the shipping line. When the customs and the shipping line release the container, you can go ahead and deliver it wherever they want.

**Question:** If you need to keep your customers inform, you need information about the
trucking, right? Or how do you do that?

**Bart:** What is really important for the clients is when the container arrives in Rotterdam and it is always information you get from China about the ETA. So you can look at the site of the shipping line, and also the ECT website. Most vessels arrive at ECT or APM, I always check it at ECT website. The information at ECT website is very accurate.

**Question:** When do you start planning the transport here in Europe. So there is a ship which is on his way from China to here. You know you have to arrange the transport from here to Eindhoven, when do you start planning the transport?

**Bart:** You always have to be very carefully that the goods are released by the Customs, before you can confirm anything. So, I usually wait till the container is here, unloaded from the vessel. When the goods are physically in the EU, you are allowed to issue the Customs clearance, and send your order to the customs in the system, with that you confirm that the goods are available here in case they want to do a check or whatever. After the goods are released from customs, when you have two releases from the shipping line and the customs that is the moment when you can arrange the transport. So usually, when the vessels arrives on Monday, the containers are unloaded from the vessel on Tuesday (sometimes it does take 24 hours) I perform the Custom clearance as soon as they are unloaded. Usually they are released in two minutes. When I get the release at my desk I make sure that I already have a release from the shipping line. Because it is something what you can do arrange in advance.

**Question:** What is the difference between the release by the customs and the shipping line?

**Bart:** The shipping line wants an original bill of lading. The goods are accompanied by the shipping documents. The original bill of lading is issued in the port of loading, it tells information about what is in the container, who the sender is, who the receiver is, the vessel name. All the information is mentioned on the bill of lading. It should be in most of the times original document, which the receiver has to hand over at shipping line office in the port of destination. The receiver has to give the original bill of lading together with the payment if any charges to be paid for the transport or local charges in Rotterdam to the shipping line here, then they receive the release. The shipper receives the original bill of lading at first and sends it over to the receiver. So if there is any problem with the payment for the goods, they just do not send the original bill of lading.

**Question:** So it is physical, it is not electronic?

**Bart:** It can be electronic too. It stays physical a lot of time. Because if you have bill of lading you have the goods in your hands. It represents the value of the goods.

**Question:** Some container terminals work with the PIN codes for the release.

**Bart:** It is not mentioned in the bill of lading. If the shipping line receives the original bill of lading, they can give a PIN code, it is what you want to have. It is a release from the shipping line. It can be a PIN code, sometimes it is a container number. They have to perform something on the terminal, they give information to the terminal Release this container on this Pin number. Because you handed over the bill of lading and the payment, they give the same number to you. You can make sure that your truck driver can pick it up with that number.

**Question:** What happens to the container if the bill of lading is not on time or not released.

**Bart:** Of course, it can happen. There is a problem with the payment between the receiver and the sender. That is always possible. So the container is here, but it cannot be released even it is released by the customs. After some days the Demurrage will start. Depending
on the shipping line on which container arrives, the container have a certain amount of free time in the port. The owner of the container itself, not the goods which are inside, is the shipping line. They need this container for further transport. You rent this container. In the rate you paid for the ocean transportation, three or four days are included for the use at the port of destination. Besides the Demurrage charges are included, which are paid in advance. It happens a lot.

**Question:** Who bares these costs?

*Bart:* Finally, the receiver on the goods. If we are involved in that, it is not our problem of course, because the client, the receiver does not have a original bill of lading, so he cannot give me the original bill of lading, so I cannot bring it to the shipping line. It is not my problem, because they have the problem with the sender. And then the container arrives, the Demurrage starts and all the charges I have to pay to the shipping line are finally for the receiver, for my client.

**Question:** Do you register the containers at the terminal, or is it fully done by the shipping line?

*Bart:* At terminal? What I do, the customs document that I issue, has a number and register the number at the website of ECT. So I give the container number, I check if it is available, I mention the custom document number. And then Customs also release at the terminal. Sometimes you have that both releases are at the terminal, so that the trucker does not have to show anything except the PIN Code.

**Question:** Do you also do the custom brokerage? How does it work?

*Bart:* Custom brokerage is another chapter, but as soon as you perform a custom clearance, it is when the goods arrive, I receiver the message from the Customs that it is released (or not released), then I perform the action and put it on the ECT website. I can also give the document to the trucking company. Some terminals does not have the WEB-services for such things, so you just give the documents to the trucker. He goes to the terminal, gives the document and then they release it in the same way. It is always good to do it in advance. So that the container is released already. So there is no reason to keep the driver waiting.

**Question:** The Customs releases the container, the shipping line releases the container and then you start planning inland transport.

*Bart:* If it is really urgent you can always call your trucking company and say, the vessel arrives on Monday. Maybe the container is ready on Monday, Tuesday morning, please make sure that the truck is scheduled very tight, that the truckers are on time. Of course, you can do it in advance. But you cannot send you trucking order in advance. Some people do it but I do not like it because I want to make sure that the container is released by Customs. Only then you can confirm the order.

**Question:** And is it one day before the physical transportation¿?

*Bart:* Yes, it should be one day before the physical transportation. It can be two days, three days it depends on when the clients want them. If I have truck ready on Wednesday to load the cargo, and I can only make my transport order on Tuesday morning, that is the first moment when I can get a Customs release, then on the same day. Sometimes it is very important to plan it very tight, if not necessary you do not do it.

**Question:** Does it happen that the truckers wait at the terminal for the container release? Or as you said, you arrange everything before the booking.

*Bart:* It does happen sometimes. If the client wants me that the trucker waits on the container terminal till the container is unloaded and the clearance is received. If there are in such a hurry I tell them that I can put the trucker there, but we can always get a
problem from the Customs. So I switch the responsibility to the client, I tell them that the waiting hours are so much for the trucker, please bare in mind that the container still will be blocked and we would be not able to pick it up at all. So it is important to make appointments about that in advance.

Question: Do you provide the container terminal with the information that the container is going to be picked up by the truck or barge or what so ever. Or is it like that you just book the trucking company and he pre-registers his visit at the container terminal.
Bart: It does happen, but I do not do it by myself. If the container is booked by truck, I just put the document on the website and they just hand the document.

Question: But do you mention the next transportation mode in your documents that you put online?
Bart: I do not give it to the shipping line.

Question: So the terminal does not know what the next transportation mode is.
Bart: I do not think so, but I have to be careful with that. So I do not think they know it. Barge operator has to give the loading and discharge list, I think 10 hours upfront.

Question: But the trucking companies sometimes need to pre-register their visit too.
Bart: They also register that. But it is only 24 hours upfront.

Question: Do you sometimes import the container not on the container terminal but somewhere inland? I mean the customs import?
Bart: For many container I make T1 document, so it is picked up under t1 document from the terminal and brought here. We unload it here in the warehouse, it is called Customs bounded. So the goods are cleared yet. The goods are not allowed to leave the warehouse, they are not free European goods. So we have a license to store the goods here, which are under the Customs supervision.

Question: Is it different?
Bart: Customs wise it is very different.

Question: But for you as a planner? Are your procedures different? So you do not have to get a Customs clearance at the terminal.
Bart: It works the same way. When I enter the Customs document I can mention if it is either the T1 document or Customs clearance document. I can enter on the website what kind of document it is. You can also see on the number what kind of document it is.

Question: But the Customs have the same interests for the container at the terminal? Like if they want to put it on the scan?
Bart: Usually if they want to put the container in the scan, it is predetermined before the container arrives, usually. If they want to do the check not on the pre-arrival, they want to do the check on my import custom document, then they allow me to pick up the container, sealed, from the container terminal, bring it here to the warehouse, make an appointment with the Customs officer, and they can perform the investigation here.

Question: The planning of the inland transport is not different if it is transported under T1? Still you need to have a shipping line clearance, and the Customs clearance
Bart: Yes, besides it is not the Customs clearance but it is a Customs document, it stays under the customs supervision. It is not yet cleared.

Question: So you have this license, how does it work? So, you have the goods which are not yet cleared, how do they get cleared, when?
Bart: They get cleared depending on what the client wants, there are different reasons to keep the goods un-cleared: most of them are fiscal. Sometimes they do not know what they want to do with the goods, maybe they will use it to make other goods with it, and then they perform the Customs clearance for the produced this product. Sometimes they
export the goods. So there are different reasons to do that. But many clearance that I
make are for the goods that are sold. For example, my German company sells the goods to
the company in Denmark, so I perform the Customs clearance in Denmark. I pay all the
Danish charges and taxes.

**Question**: Do you have AEO certificate?

**Bart**: Yes,

**Question**: Do you ask the trucking companies who work for you, whether they have or
not?

**Bart**: Yes, we ask them. In most of the times, you can see it, because the companies are
happy that they ot it, so you see it in their emails. We tend to work with the companies
who have AEO certificate.

**Question**: We just had the import container. Do you also do the export containers?

**Bart**: I do the export containers, but not many.

**Question**: How does it go? You get a call, that there is a container.

**Bart**: Yes, there is a loading for the client. I have a client who exports beer. They load it
here in the warehouse. It is under Customs supervision because it is for export. Then they
give me the order to load the container. I give a order to transport company to pick up the
empty container from the container yard, bring it over here. My colleagues load it here,
it is not on pallets. This is loose loaded in the container. As soon as it is loaded, I know
what the order number is, how many pieces there are in, we can make a Customs export
document here. The export document is the same as import document. We make it in the
name of the receiver, in this case the seller of the goods. You receive the release from the
Customs that you can move it to the terminal. At the terminal you have to show them
the export document. Then the terminal takes the container and they handled it for the
outgoing on the sea-vessel. For this cargo, I do not do the bookings at the shipping lines. I
just receive the pickup reference. Normally you do the booking at the shipping line. You
tell them that you need 24 foot container to Sydney. Then they let you know what kind
of vessels are available, or what is the sailing times. When you confirm the booking, you
receive the pickup reference for the empty container. They also give it to the container
yard, which has the containers. If you go there, they know what kind of container they have
to give you. Usually, the container number is not yet known. It is known at the moment
you pick up the container. So they just they have the list of the containers and choose the
container for you. It is the moment when the container number becomes known.

**Question**: What is the maximum weight for the container?

**Bart**: It depends on the size of the container. For 24-foot it is 27 tons. I am not really
sure about it. I have to check it. It also depends on the shipping lines and on the road
regulations. You have to check it in advance. So it actually can be different every time,
because maybe it China or Australia there is a maximum weight of 25 tons for road
transport. I do not to have to check it, but the receiver has to inform me on time.

**Question**: But when you are loading in your warehouse, you also need to check the weight?

**Bart**: Yes, we do not weight it here ourselves. You, of course, can weight pallets, we can
do it. You should know the weight of one pallet and then do the math.

**Question**: When you receive the order for the import container, do you check all these
regulations, German roads, trains?

**Bart**: Yes, if the goods go to Germany you have to really check it. Absolutely. Germany
has quite tight regulations. Usually the trucking company also knows that. When I book
them, I mention the weight and they already can tell me whether it is a problem. If it
is the problem, we can unload it here and do it in two parts. If something happens to
the container, the shipping line wants to know. When it is unloaded here, something can happen here. For example, we damage it, if we do not say anything (but we do say) and the container gets returned to the empty container yard. Then the people over there check it. It is always important who is responsible for the damage.

**Question:** About the goods?

**Bart:** The goods. As soon the container arrives here, we open the containers and make photos of the goods. Even if it is not damaged. So if the goods come up damaged, we can see if the container was stored properly at the loading side. We do it here also, so we know exactly how to stuff the container, so that the goods are not damaged during the transportation. But if it does happen, we always check who is responsible, who can be responsible for it. And then we inform the client about it. If the container gets unloaded here with damaged goods, we make pictures, we email it directly to the client: this is how we received it, please let me know, who we should hold responsible for that. Maybe, they do it themselves, because it was not stuffed properly. The receiver can hold the sender of the goods responsible.

**Question:** Do you transport refer transport?

**Bart:** It can happen, but we do not have refrigerators in our warehouse. It can happen that the client has refers. I have seen it.

**Question:** If the refer containers comes broken down. So what would you do?

**Bart:** I did not experience that. But I think I would say that the shipping line is responsible.

**Question:** And shipping line calls you to say that they have just checked the temperature and the temperature is not as it should be in this container. What would you do then?

**Bart:** I think there are responsible for it. The temperature is mentioned in the bill of lading. So they are responsible that the goods on that temperature whole time from the port of loading till the port of unloading. If they contact you, and say that the temperature is not high enough (low), if you cannot use the goods anymore, you have to hold them responsible for this. Always notify the receiver of the goods, because these are his goods. Ask him what to do, and tell him that we can hold the shipping line responsible.

**Question:** Does the shipping line actually call you and tell you that something is wrong?

**Bart:** I am not sure. Not always I think. I have never had something like this.

**Question:** Do you know how the container terminal operates?

**Bart:** Yes, I have been on the container terminal, I have the good idea, but I do not exactly know who it works.

**Question:** Why is it better for Container terminal if you pre-register the next transportation mode? Do you know how the way you book the trucks affects them and other way around? How does their plans affect you? It is what we are looking for.

**Bart:** Sometimes it takes 24 hours for the container to be unloaded, if you need it really urgently, I do everything what it takes to get the container as soon as possible. What I do is I call the shipping line and ask them whether they can unload my container first. Sometimes it is not possible if it is deep in the vessel. We also call the terminal, and they just do not give this kind of information. If you ask them whether they know when the container is going to be unloaded, they say: it should be unloaded within 24 hours. It happened that ones the person on the telephone told me this information. But normally they do not provide us with this information. I do not even try anymore. I just call the shipping line

**Question:** Because you are not their client?

**Bart:** Correct. And when you call the shipping line, which is also big. So you can get an
answer within 24 hours, but it is already late. The shipping line is always involved, because they are the clients of the terminals. You can request an urgent offload. So that they can offload the container earlier than average. I do not do it anymore because it takes a lot of work and it does not really help. But it is a good thing in communication between the shipping line, the client, (what we are in this case) and the terminal. Of course I hear what the truckers say, because I have a direct contact with them. They also inform me when there is a delay on the terminal, they call me and they tell me what the problem is, so that I can call the shipping line to look whether they can fix it. That is also important what the trucker experience at the terminal. The trucker is my eyes on the terminal.

Question: So if he is in the line and he already knows that he will be waiting in the line for 3-4 hours, he calls you?

Bart: Yes, he calls me. And if needed I call the shipping line and say that that the line is too long and who is going to take these costs. Sometimes you need to be a little bit pushing.

Question: Do you know how the containers are processed on the terminal?

Bart: A little bit, not really. I know when they off board, they put it in stack, I am not sure if they put straight into the stack, it depends on the terminal. When the container is in stack, then the container is available, so you can see on the website that it is available, the container is there. I am not really sure.

Question: But do you know what kind of information is needed to put it on stack?

Bart: No. I have no idea.

Question: Do you know how the trucking companies work? What kind of horizon planning they use?

Bart: I happen to know that, yes, because I deal with the trucking companies, I am their clients. So when I need any information, they are always willing to help. The company which does local trucking for us, is located here, in this building, they rent the part of our office. It is very good. I just walk in, and give them the transport orders and I talk to them about the problems their truckers experience at the terminal.

Question: Don they not try to push you to extend the planning horizon from one day to 24 days. So that they receive orders from you not 1 day before the transportation but earlier?

Bart: That is what they want, but I always back them up a little bit, because I am their client. And I am telling when I have a transport order, I can be late, so they have to understand that I am late and if they cannot perform the transportation, I most of the times wait for them. I do not have other option, sometimes I can engage somebody else, but I prefer to wait for them. Yes, if I can I give them the order as soon as possible. They also very tight with planning, so it is not a very big deal.

Question: So you can still imagine, having a park of 30-50 trucks and not knowing in the morning what you have to transport tomorrow.

Bart: That is true. The trucking companies, they do not have, they do not know, when something is wrong, they do not have idea what is going on. We just pull them and push them back all the time. They do not know where they are standing. This is hard part of being the trucker. They are always here, they are working from 7 o clock till 9 o clock in the evening. The guy who is doing the planning, he is always here. Because everything is constantly changing.

Question: Do you know how the barges work?

Bart: I told you something about the loading lists, that is because I worked with them. But to be honest not really. I know that the containers has to be made ready by the
terminal, to get on barge. Probably, they stay on the water side, where the barges come. So they move the containers to that stack.

Question: Do you have sensitive information that you do not share with your partners?
Bart: What kind of goods we have in our warehouse. It is always important. We have an office with warehouse, you have to be careful with it. If I give the trucking company an order to load here, small shipment of two pallets with the certain goods which are imported only by one specific company. Maybe he works with the other company who works with the same goods. So you have to be careful to whom you are giving the order. And they can always derive some information based on the loading address, offloading address, type of goods they are transporting. You have to make sure that they do not find out that you are using somebody else.

Question: One of another important things is what are the main problems that you see in this business, that you encountered on regular basis, what could be better in your opinion.
Bart: Well the big problem, maybe you already heard about this, is the waiting hours at the gate of terminal, and it is getting longer. And we hear from the truckers about this every time. 2-4 hours is getting normal to wait. And I do have the problem with this, because the personal at the warehouse leaves at 4 oclock. So if I tell the trucker to pick the container up from the terminal, even in two days in advance, and bring it to the warehouse. He plans to pick it up at one oclock so that he is here at 2 oclock, thus enough time to unload the container. But due to the delays he comes here at 3-55, so he is too late, and I have a problem here then, because I cannot send the cargo tomorrow, because we can only unload the container tomorrow. So the whole chain is influenced. That is one of the biggest problem. I have to think about other problems.

Question: It would be interesting to know. Do you have issues regarding Customs?
Bart: Not really. We also have a Customs office here. They come to my desk, they tell me that they want to do a physical inspection. I always go with them to the warehouse to be there, to take pictures, write down everything. I have my own problems like if my client sells the goods that are stored here to somebody else, they make an appointment to pick up the goods between themselves, so my client does not tell me to do the transport, but he tells me that their client is picking up the goods. I give the pick-up reference and when the trucker is here he shows us this reference.

Question: What kind of other problems do you experience? For example breakdown of the computer system at the Customs?
Bart: Yes absolutely. With the Customs it has been quite ok lately. We do not encounter such a big problems anymore. But it does happen that the system is running down, and we do not have the connection with the Customs system. So we send the Customs clearance to nothing, so you cannot move the goods. This is the problem. What can we do? Just inform the client. Sometimes we have to cancel the transport. There are other possibilities to call the Customs and ask them for emergency procedures. If it is a really big issues in the system, they can release it.

Question: If there are a major distributions, like a trucker strike, for example.
Bart: I would not say truckers, but the terminal personnel.

Question: Lets say there is a strike. How would you deal with such situation? Did you ever experience that?
Bart: Only thing I experienced is the strike at the terminal. Two or three weeks ago. What can I do? I can only inform the client. You can call the shipping line and get angry, but they cannot help you either, probably.

Question: But if you maybe know that there is strike, you call them to drop the containers
at other port?

Bart: It happens, it happened few years ago. The shipping line itself made the decision, to not go to Rotterdam, but unload all the container at Antwerp or Hamburg. And they bring it here by barge, or you can pick it up there. That happens.

Question: I am interested in how you prepare the alternatives, how you are prepared.

Bart: It is always important for the freight forwarder to contact your client and ask them what you should do, because it is their goods. I can advise them but it always depends on the costs involved, how much time it is going to take. These are the things you have to inform you client about.