Abstract

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Title: Information Integration in Intermodal Freight Transportation

Background:
In the past, enterprises had no recognition of information integration and operated as independent units within a chain. As a result, most of the firms throughout the supply chain faced inadequate information sharing, lack of collaboration, and absence of compatible IT infrastructure. Theses three elements play a crucial role in information integration that assists companies’ goal congruence. In a highly competitive market, companies from different industries take these three elements into consideration in order to synchronize their activities. Nowadays, transportation industry plays a crucial role in all developed countries in order to fulfill the customer’s needs and act as a connection between manufacturers and consumers. Intermodal freight transportation is one of the elements of transportation industry that includes two main players - freight company and terminal operator.

In this respect, it is essential to review theoretical framework and explore the practice of information integration within intermodal freight transportation. Hence, this study carries an investigation on information integration in accordance with theoretical framework from the perspective of the dyad that includes a freight company and a terminal operator.

Purpose:

The research defines the level of information integration within intermodal freight transportation. A freight company and a terminal operator are the players studied in this research. Three elements of information integration, which are collaboration, information sharing, and IT implementation and adaptation, are investigated in order to identify the level of
information integration. The main objective is to understand the information integration and its level within the industry from a dyadic perspective.

**Method:**

This research is conducted from a positivist scientific perspective along with qualitative research method and deductive approach. The authors conduct the embedded multiple-case study with a dyadic perspective. In this context, the freight companies and terminal operators are the studied players within this research. In order to gather the empirical data, semi-structured interviews are conducted via telephone and email. Empirical data is analyzed by utilizing two different methods, which are within-case and cross-case analysis. Furthermore, ethical issues are considered in this research, based upon trustworthiness and accuracy.

**Result, conclusion:**

The conclusion of this research is based upon within and cross case analysis. Three studied dyads have shown the same result of medium level, while one dyad has demonstrated high level of information integration. In this regard, each dyad has been rated separately in accordance with the theoretical framework that provides scale with low, medium and high levels regarding collaboration, information sharing, and IT implementation and adaptation in order to find the level of information integration. From the dyadic perspective and with help of cross case analysis, the level of information integration regarding the whole research population is defined at medium level. It is remarkable that obtained results, in accordance with the theoretical framework, are different from the companies’ representatives’ perception of information integration.

**Keywords:** information integration, collaboration, information sharing, IT implementation and adaptation, freight company, terminal operator, intermodal freight transportation, container handling.
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Linnaeus University, Växjö, Sweden, May 27, 2015

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# Table of Content

List of Figures ................................................................................................................................. vii
List of Tables ................................................................................................................................... vii
List of Abbreviations ......................................................................................................................... viii

Chapter 1. Introduction .................................................................................................................. 1
  1.1 Background ............................................................................................................................. 2
    1.1.1 Transportation Industry and intermodal freight transportation .............................................. 2
    1.1.2 Information Integration in Supply Chain .............................................................................. 5
    1.1.3 Information integration between freight company and terminal operator ............................... 6
  1.2 Problem Discussion .................................................................................................................. 8
    1.2.1 Issues of Information Integration between freight company and terminal operator ............... 8
    1.2.2 Problem statement .............................................................................................................. 10
  1.3 Research Question .................................................................................................................... 11
  1.4 Purpose Statement .................................................................................................................... 11
  1.5 Research Disposition ............................................................................................................... 11

Chapter 2. Methodology ................................................................................................................. 13
  2.1 Scientific perspective .............................................................................................................. 14
  2.2 Research strategy ..................................................................................................................... 16
  2.3 Scientific approach ................................................................................................................... 17
  2.4 Research design ....................................................................................................................... 19
  2.5 Sampling .................................................................................................................................. 21
  2.6 Data collection ......................................................................................................................... 24
  2.7 Data analysis ............................................................................................................................ 26
  2.8 Research quality ....................................................................................................................... 28
  2.9 Ethics in Research .................................................................................................................... 29
  2.10 Summary of methodology ..................................................................................................... 31

Chapter 3. Introduction of IFT and its players ............................................................................. 32
  3.1 Containers and Containerization ............................................................................................ 33
  3.2 Players within a transportation chain ....................................................................................... 34
    3.2.1 Freight Company ................................................................................................................ 34
    3.2.2 Terminal .............................................................................................................................. 34
    3.2.3 Terminal Operator ............................................................................................................. 35
  3.3 Container flow ......................................................................................................................... 35

Chapter 4. Theoretical Study ......................................................................................................... 38
  4.1 Information Integration ............................................................................................................ 39
    4.1.1 Information Integration in a SC ........................................................................................ 39
    4.1.2 Information Integration in IFT ........................................................................................ 40
  4.2 Information Integration Elements ............................................................................................ 40
List of Figures

Figure 1. Container Flow in a SC ................................................................. 3
Figure 2. IFT Dyad ...................................................................................... 7
Figure 3. Research Disposition ................................................................. 12
Figure 4. Types of Case Study Designs ..................................................... 20
Figure 5. Container Flow in a Transportation Chain .................................. 36
Figure 6. Container Handling inside an Intermodal Terminal ..................... 37
Figure 7. Information Integration in IFT Dyad ........................................... 49
Figure 8. GPS in OOCL ............................................................................. 57
Figure 9. Container Handling on Arrival in TC-CL .................................. 60
Figure 10. Container Handling on Departure in TC-CL ............................... 61

List of Tables

Table 1. Research Sample .......................................................................... 22
Table 2. Summary of the Research Methodology ......................................... 31
Table 3. Levels of Information Integration in a SC ................................... 50
Table 4. Levels of Information Integration in IFT ..................................... 51
Table 5. Summary of the Theoretical Framework ....................................... 52
Table 6. Information Integration in Dyad 1 "Vietnam HCMC" ....................... 85
Table 7. Information Integration in Dyad 2 "Vietnam BRVTP" .................... 87
Table 8. Information Integration in Dyad 3 "Iran" ......................................... 90
Table 9. Information Integration in Dyad 4 "Russia" ................................... 93
Table 10. Information Integration in IFT ..................................................... 98
Table 11. Perception of Information Integration Level within IFT ............... 99
Table 12. Summary of the Research Findings ............................................. 101
## List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>BRVTP</td>
<td>Ba Ria-Vung Tau Province</td>
</tr>
<tr>
<td>CPFR</td>
<td>Collaborate Planning, Forecasting and Replenishment</td>
</tr>
<tr>
<td>CRM</td>
<td>Customer Relationship Management</td>
</tr>
<tr>
<td>EDI</td>
<td>Electronic Data Interchange</td>
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<tr>
<td>ERP</td>
<td>Enterprise Resource Planning</td>
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<tr>
<td>FEU</td>
<td>Forty-foot equivalent unit</td>
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<tr>
<td>GPS</td>
<td>Global Positioning System</td>
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<tr>
<td>GSM</td>
<td>Global System for Mobile communication network</td>
</tr>
<tr>
<td>HCMC</td>
<td>Ho Chi Minh city</td>
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<td>IFT</td>
<td>Intermodal Freight Transportation</td>
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<tr>
<td>ISO</td>
<td>International Standard Organization</td>
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<tr>
<td>IT</td>
<td>Information Technology</td>
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<tr>
<td>MOL</td>
<td>Mitsui O.S.K. Lines</td>
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<tr>
<td>MRP</td>
<td>Material Requirement Planning</td>
</tr>
<tr>
<td>NCSP</td>
<td>Novorossiysk Commercial Sea Port</td>
</tr>
<tr>
<td>OOCL</td>
<td>Orient Overseas Container Line</td>
</tr>
<tr>
<td>PPH</td>
<td>Pre- and Post-haulage</td>
</tr>
<tr>
<td>RFID</td>
<td>Radio Frequency Identification</td>
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<td>SC</td>
<td>Supply Chain</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>---------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>SCM</td>
<td>Supply Chain Management</td>
</tr>
<tr>
<td>TCIT</td>
<td>Tan Cang Cai Mep International Terminal</td>
</tr>
<tr>
<td>TC-CL</td>
<td>Tan Cang - Cat Lai Terminal</td>
</tr>
<tr>
<td>TEU</td>
<td>Twenty-foot equivalent unit</td>
</tr>
<tr>
<td>TME</td>
<td>Tidewater Middle East</td>
</tr>
<tr>
<td>VMI</td>
<td>Vendor Management Inventory</td>
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<tr>
<td>XML</td>
<td>Extensible Markup Language</td>
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Chapter 1. Introduction

In this chapter, the authors will present the readers with the background of the thesis to introduce the chosen industry and the concepts that will be used in the following research. Information integration is taken as a center concept for this research and will be presented to the reader on a general level. Furthermore, the transportation industry will be presented following by intermodal freight transport as later, which is chosen for a field of study.

The chapter also includes problem discussion, research questions and the purpose of the study. The introduction chapter is included in the research in order to provide the reader with a clear idea about the intentions, expectations and the structure of the thesis.
1.1 Background

1.1.1 Transportation Industry and intermodal freight transportation

Before the industrial revolution, there were only animal and wind for land and sea transportation in order to carry goods and passengers from one location to another location and the most convenient way was maritime transportation (Rodrigue, Comtois, & Slack, 2013). In the 21st century, there are three main categories for transportation industry - land (road, rail, pipeline), water (shipping), and air (Coyle et al., 2011; Rodrigue, Comtois, & Slack, 2013). Transportation plays a key role in all industrialized countries and provides the bridge between producers and consumers (Coyle et al., 2011). Hence, transportation is one of the essentials for developed economies to fulfill the orders (Ibid). Due to global competition, there is a high demand for transportation and supply chain sectors (Plunkett, 2009). It can be claimed that transportation can act as a glue to keep the supply chain together and it can help enterprises to enhance their supply chain integration (Coyle et al., 2011; Grabara, Kolcun, & Kot, 2014).

One of the elements within the transportation industry is intermodal freight transportation (IFT) with its complexity of loading and unloading goods with help of available equipment (Rodrigue, Comtois, & Slack, 2013). According to United Nations Economic Commission (2001 cited in Ye, Shen, & Bergqvist, 2014, p.290), intermodal freight transportation is defined as:

“The movement of goods in one and the same loading unit or road vehicle, which uses successively two or more modes of transport, without moving the goods itself in changing modes”.

Loading unit in this definition is considered as “a consignment of freight-invariably, but not always, comprising a combination of small consignments, ... which is unitized to save transshipment and re-packing time and cost at each individual stage of the journey, and also for ease of handling” (Lowe, 2006 cited in Ye, Shen, & Bergqvist, 2014, p. 291). And the same loading unit refers to a standard loading unit that is globally recognized as a container and standardized by international standard organization (ISO) (Ye, Shen, & Bergqvist, 2014) - ISO container. Standardized containers are developed into different dimensions of length, width and height. Among different types of containers, TEU (twenty-foot equivalent unit) and
FEU (forty-foot equivalent unit) are the most frequently used (Lowe, 2006; Carlo, Vis, & Roodbergen, 2014).

For this research, the authors define the borders of a container flow within scale of a supply chain. The area of the supply chain, where container handling takes place, is demonstrated in Figure 1 below. As it can be seen, the container handling process in particular do not take place through the entire supply chain. The transportation chain, which is shown in the lower part of Figure 1, is taken in the research focus and will be described in detail in chapter 3.

Figure 1. Container Flow in a SC

![Figure 1. Container Flow in a SC](image)

Source: composed by the authors (based on Lee, Park, & Lee, 2003; Lai 2005; Lamberg & Frostberg, 2007).

As the industry emerges as a complex matter, it cannot be covered within the given research frame. For that reason, the authors narrow down the industry scale to IFT industry. In the upcoming research, the authors are to build the investigation around three modes of IFT - road, ship and railroad (Rushton, 2010). Here it can be noted that the air mode is excluded from the research object as the airfreight commonly appears as a transportation mode with different type of intermodal containers (Harrison, 2006), which allows to exclude the mode from the chosen frame of research.

The development of the IFT appears as a major force within the transportation of goods (Konings, Priemus, & Nijkamp, 2008; Marchet, Perotti, & Mangiaracina, 2012). In this
respect, container handling process is indispensable in the IFT where freight companies are able to move their goods from one location to another location (Bonacich & Wilson, 2008). High demands from the customers and economies of scale are two significant drivers in container handling operations (Ibid). Beside these two drivers, speed, reliability and low cost are three remarkable factors that can retain customers satisfied (Ibid). Specialized cranes are used in IFT to store and retrieve container from the specified place inside the terminals, where interchange of transportation mode can take place in container handling process (Ibid). The summary of literature in the IFT considers freight companies and terminal operators as the two main actors in a transportation chain (Konings, 2008; Rodrigue, Comtois, & Slack, 2013). According to Rodrigue, Comtois and Slack (2013), a freight company is known as an organization that is responsible for carrying goods and related services on behalf of shippers. Terminal operator is a venture that operates in a terminal, which appears to be a part of port (Konings, 2008; Rodrigue, Comtois, & Slack, 2013). These can be classified into 3 types according to one-year volume of the container throughput (Fossey, 2007). Hereby, volume of less than 500,000 TEU stands for small size, container throughput within frame of 500,000 and 2,000,000 TEU stands for medium size, and throughput over 2,000,000 TEU stands for large size (Ibid).

As demand for IFT is increasing, area utilization is essential in the terminal where terminal operators and freight companies should find the way in order to have efficient container operations as well as track and trace the shipments (Konings, Priemus, & Nijkamp, 2008). In this regard, in order to enhance the operation, terminals tend to use electronic data exchange to have a pre-information and real time data for a better coordination (Ibid). In this context, the efficiency of supply chain can be improved with respect to maximize container use, reduce container handling time and make better use of resource (Langer & Vaidyanathan, 2014). In addition, by having an advanced technology the real time and visibility of information can increase customer value (Coyle et al., 2011). Furthermore, Konings, Priemus and Nijkamp (2008) stated that by considering advanced technology intermodal collaboration could be more attainable.
1.1.2 Information Integration in Supply Chain

Today’s hyper-competitive environment on the global scale faces organizations with the necessity of taking the supply chain perspective in their activities in order to be on top of their game (Barratt & Barratt, 2011). Cost, time and activity efficiency are no longer a question of inner perspective of the company alone, but rather a result of collaborative efforts within a supply chain (Jonsson, 2008; Koçoğlu et al., 2011). Collaborative behaviour and working towards the supply chain integration can be fairly called essential aspects of the supply chain perspective (Koçoğlu et al., 2011; Rashad & Gumzej, 2014). Expansion of the demand for supply chain integration has attracted attention of scholars and players from the field, which results in development of the concept complexity (Koçoğlu et al., 2011). As a result, supply chain integration can be approached on various dimensions (Holmberg, 2000; Lee, 2000; Ngai et al., 2011). One of these dimensions is the information integration that is taken as a center concept in this research (Ibid).

Information integration in its theoretical and practical notions emerges as an important concept that attracts scholars’ attention (Rashad & Gumzej, 2014), which could be one of the reasons for high variety in its understanding and defining. Authors approach the information integration in various ways that lead to diversity of definitions in research (Flynn, Huo, & Zhao, 2010; Koçoğlu et al., 2011). For this reason, the authors agree upon one information integration definition that is extracted from multiple sources (Handfield & Nichols, 1999; Koçoğlu et al., 2011; Laudon & Laudon, 2011; Prajogo & Olhager, 2011; Kalyar et al., 2013; Gonzálvez-Gallego, 2014) and is used throughout the article:

*Information Integration refers to linking the information within a supply chain into one system that includes three main elements - collaboration, information sharing, and IT implementation and adaptation.*

Referring to the provided definition of information integration, the authors’ approach for the investigation of this concept includes the three elements. Thus, in this research the information integration between the players of a supply chain includes collaboration, information sharing, and IT implementation and adaptation as the core elements.
1. Collaboration

Collaboration between the supply chain (SC) partners is a shared “responsibility of exchanging common planning, management, execution, and performance measurement information” (Daugherty, 2011, p. 22). Collaboration appears as an element that is directly linked to information sharing and technological connectivity between players (Adams et al., 2014).

2. Information sharing

Min et al., (2005) defines information sharing as the heart of supply chain collaboration. According to Lotfi et al., (2013), information sharing implies the distribution of necessary information to people or organizational units. Information sharing represents element of information integration that is studied the most due to the advantages it provides within a supply chain (Min et al., 2005; Wong et al., 2011; Lotfi et al., 2013).

3. IT implementation and adaptation

The importance of information sharing is widely known across supply chain players, however its implementation entails the support of information technology (Marinagi, Trivellas, & Sakas, 2014). Implementation and adaptation of IT enables improvement of communication, coordination, problem solving within the whole SC (Ngai et al., 2011; Prajogo & Olhager, 2011).

1.1.3 Information integration between freight company and terminal operator

Information integration emerges as an essential tool within a modern supply chain (Bagchi & Skjoett-Larsen, 2003; Wong, Lai, & Cheng, 2011; González-Gallego, 2014). That allows to conclude that the players of the IFT have to accept the necessity of information integration in their SC. Within IFT industry, there are two main kinds of players who are involved in the processes related to information integration (Lee, Park, & Lee, 2003; Coyle, 2011). These are the freight companies and container terminal operators (maritime or inland) (Ibid). These players are the actors who organize and perform the information integration within the chain as being shown in Figure 2 (Lee, Park, & Lee, 2003; Lamberg & Frostberg, 2007). In this thesis, information integration within this dyad will be investigated and approached from the perspective of three elements.
Information Integration in Intermodal Freight Transportation

1. Collaboration between freight company and terminal operator

The flow of information between actors within a transportation chain can be a source of collaboration within this chain (Gonzalez-Feliu, et al., 2013; Wang & Cullinane, 2014). Collaboration can also be increased with the help of effective information distribution between terminal operators and freight companies (Wang & Cullinane, 2014). Furthermore, tight relationships between the transportation chain actors can boost the quality of decision making on the scale of individual organization and the whole chain (Ibid). It is essential for a freight company to choose reliable partners within the transportation chain as it empowers cooperation among the players (Lamberg & Frostberg, 2007). Collaboration becomes a critical matter when it comes to challenges of competition among different chains (Ibid).

2. Information sharing between freight company and terminal operator

According to Caris, Macharis and Janssens (2013), information flow plays an important role in the transportation chain. With a large amount of container handling at terminals, precise and prompt information do not only enable terminal operators, but also freight companies to manage their work efficiently (Ibid). The transparency of information sharing between terminals and freight companies enhances container handling operation (Lee, Park, & Lee, 2003; Coyle et al., 2011). Moreover, pre-information sharing allows players in the transportation chain to optimize their resources used for container handling (Lee, Park, & Lee, 2003).

3. IT implementation and adaptation between freight company and terminal operator

Intermodal transportation operation requires a large volume of data from its players including freight company and terminal operator (Kia, Shayan, & Ghotb, 2000; Grabara, Kolcun, & Kot, 2014). In order to process and exchange that substantial information, information technology (IT) is utilized to support the process (Kia, Shayan, & Ghotb, 2000). Lack of IT usage is
considered as one of the reasons that can cause terminal gridlock (Ibid). Use of up-to-date technology allows to enable the information flow among players in the chain and communication at container handling terminals (Grabara, Kolcun, & Kot, 2014). For instance, automatic container tracking system or other electronic devices can be applied and provide data for all involving players through compatible operational computer applications (Kia, Shayan, & Ghotb, 2000).

According to Cai, Jun and Yang (2010), collaboration evidently plays the key role in information integration within transportation chain. Freight companies and terminal operators can create a control system in order to facilitate the information sharing (Özener, Ergun, & Savelsbergh, 2011). Moreover, to ease the information sharing process, one player’s IT needs to be implemented and adapted to the other players (Ibid). It is noticeable that having the same platform in IT system can increase the commitment to the whole transportation chain (López-Navarro, 2013). In order to reach the compatible IT system, collaboration is considered as the key factor (Ibid). Finally, information integration becomes possible when its core elements interact (Özener, Ergun, & Savelsbergh, 2011).

1.2 Problem Discussion

1.2.1 Issues of Information Integration between freight company and terminal operator

The three main elements of the information integration are to be performed by all the players within the supply chain (Bhatt, 2000; Stahlbock & Voß, 2008). However, when dealing with a chain of container handling, the level of information integration can vary from its common appearance. The variations emerge due to the forms of the players that are different from the general supply chain and the forms of information flows that take place within the container handling chain (Lamberg & Frostberg, 2007). Herewith, the authors face a research challenge, as with its long history information integration is proved to be important and there is a lack of research and consistent information regarding the level of information integration between a freight company and a terminal operator (Konings, Priemus, & Nijkamp, 2008; Stahlbock & Voß, 2008). Container handling in research is commonly studied as a process within the material flow (Heaver, 2011), while the information flow does not receive equal attention in research (Ibid; Caris, et al., 2014). This gap is to be investigated and described in this thesis.
project from the perspective of three main elements of information integration that, in their turn, carry various gaps and barriers in theory and practice.

1. **Collaboration between freight company and terminal operator**

Lack of collaboration is a challenging issue for members in the transport chain (Khurana, Mishra, & Singh, 2011). This happens when both parties (freight companies and container terminal operators) are not willing to share sensitive information, as they tend to secure it from misuse (Caris, Macharis, & Janssens, 2013). According to Cai, Jun and Yang (2010), collaboration evidently plays the key role in information integration in the transportation chain. Businesses tend to share their transportation resources in order to reduce the costs and negative impacts on their supply chains (Langer & Vaidyanathan, 2014). This implies that collaboration is needed between parties in the chain (Ibid). There has been not much research on collaboration effects within the SC integration (Sridharan & Simatupang, 2013) and between different players in the IFT in particular (Caris et al., 2014). With that said, the study of collaboration practices between freight company and terminal operator allows to partly understand the element of information integration within a transportation chain.

2. **Information sharing between freight company and terminal operator**

Although the benefits of information sharing are obvious, not all managers are convinced by known advantages of the implementation of information sharing systems due to various reasons (Khurana, Mishra, & Singh, 2011). Lack of training, experience and knowledge of up-to-date technology prevents companies from conducting information sharing (Ibid). Moreover, lack of leadership and managerial instructions make it strenuous to execute (Ibid). In some cases, opportunistic behaviour makes companies reluctant to share information within their SC (Caris, Machari, & Janssens, 2013). According to Khurana, Mishra and Singh (2011), certain processes, individual and organizational behaviours need to be adjusted in order to be compatible with other partners in the chain. Furthermore, strict rules and complex procedures are the common issues that interfere with the process of information sharing among organizations (Du, et al., 2012). These issues appear within various industries and IFT in particular (Khurana, Mishra, & Singh, 2011). It can be noted that information sharing is not fully studied within the IFT and freight company/terminal operator dyad in particular (Ibid; Caris, Macharis, & Janssens, 2013). An investigation of three elements of information
integration in the dyad allows to gain a better understanding of how information sharing is perceived and implemented.

3. IT implementation and adaptation between freight company and terminal operator

There are various reasons leading to a situation where advanced IT implementation does not take place between parties in the IFT and container handling in particular (Harland et al., 2007). One of the main reasons is a possible lack of knowledge regarding the benefits that they can achieve by implementing shared IT system (Ibid). Moreover, the increasing complexity of information technology results in high investment cost (Langer & Vaidyanathan, 2014). Consequently, while large size organizations can afford to apply up-to-date IT tools, small and medium size enterprises have no skill and budget in order to follow the large size organizations (Harland et al., 2007). Furthermore, incompatible information systems make it difficult to share information among players (Caris, Macharis, & Janssens, 2013). The fast changing of technology is also mentioned in some research as difficulty of IT implementation within IFT (Harris, Wang, & Wang, 2015). Since there are not much research that investigates IT implementation/adaptation between freight company and terminal operator (Ibid), research on IT implementation and adaptation as an element of information integration will provide better understanding of to what extent they are executed within the dyad.

1.2.2 Problem statement

As being discussed, information integration has emerged as an important concept and its benefits are widely perceived across industries (Rashad & Gumzej, 2014). However, when it comes to implementation of information integration, certain difficulties may occur within the three elements of information integration that have been discussed earlier. Those issues can vary from industry to industry. From the perspective of the transportation industry, the authors came up with a conclusion that there is no exact information regarding the level of information integration between freight company and terminal operator. This notion will be used within the thesis project as a research opportunity. The authors of this paper believe that gaps can be partly filled in by doing more theoretical and empirical studies. Such a research allows to gain more knowledge about the level of information integration in container handling process and the industry it belongs to. The approach for investigation in this research will refer to the evaluation of three elements within information integration which later use for defining the
level of information integration. Theoretical research on collaboration, information sharing, and IT implementation/adaptation will be discussed from the perspective of freight company and terminal operator. The findings of the research will allow to gain clarifying knowledge regarding the key concept within the chosen industry that can benefit as researchers so representatives from the field.

1.3 Research Question

What is the level of information integration between a freight company and a terminal operator in IFT?

1.4 Purpose Statement

The lack of knowledge regarding information integration between freight companies and terminal operators appears as a theoretical gap that carries a potential for research. The authors of this thesis identify, investigate and discuss this field to partly fill in the existing gap. This research is approached by examination of the three elements of information integration, which are collaboration, information sharing, and IT implementation and adaptation. Aspects of their implementation and perception are studied and reviewed in theoretical chapter. Furthermore, the information integration and its elements are investigated through multiple case studies of organizations that represent dyad of players within the chosen industry. The information collected from theoretical and empirical studies allows to make conclusions regarding the level of information integration in IFT dyad.

1.5 Research Disposition

In order to support the reader's following of the research flow, the authors provide visual disposition to outline the research, as it is shown in Figure 3 below. *Introduction* comes as the beginning chapter that introduces the background of the studied concepts and the industry. This chapter also presents problem discussion, research question and purpose of the study. The chapter ends with disposition of the research. The next chapter - *Methodology* - narrates the method used for researching and reporting within the thesis. The aspects of scientific perspective, research strategy, scientific approach, research design, sampling, data collection, data analysis, research quality and research ethics are described in this section. In each
subchapter, the authors discuss and explain the motivation for choosing the specific methods for this particular research. The third chapter - *Introduction of IFT and the players* - introduces the reader to the objects of the study, which are the main players and processes within the IFT. Chapter four - *Theoretical Study* - portrays theoretical framework with established theory and concepts where the authors review the studied concepts and show possible theoretical gaps of the studied field. Chapter four - *Empirical Study* - comes next and includes description of the empirical study that is conducted through multiple case studies (studied organizations). The chapter provides thoughtful description of the companies and the information extracted from the interviews. The following chapter - *Analysis* - provides an analysis of the data collected from the studied cases. The cases will be analyzed by applying within case and cross case analysis method. The last chapter - *Conclusion* - summarizes the thesis results and responds to the research questions to fulfill the main purpose of the thesis. Theoretical and practical contributions are also presented together with the generalization of results, the thesis limitations, own reflections and criticisms as well as suggestions for further research.

Figure 3. Research Disposition

![Research Disposition Diagram]

Source: composed by the authors
Chapter 2. Methodology

In this chapter, the authors describe the methods used for studying and reporting the thesis. Within methodology part, sub-chapters of scientific perspective, research strategy, scientific approach, research design, sampling, data collection, data analysis, research quality and research ethics are presented. Among various considerations for doing research, those aspects are considered by the authors to be important for the thesis. In each sub-chapter, the authors discuss the motivation for choosing specific methods for this thesis.
2.1 Scientific perspective

According to Saunders, Lewis and Thornhill (2009), research is considered as a process of investigating issues in a logical way in order to improve understanding or increase knowledge regarding these issues. In the beginning of research, authors are required to adopt specific research perspectives, which determine the nature of knowledge and the way this knowledge is developed (Ibid). A research perspective includes assumptions of epistemology - “the researcher’s view regarding what constitutes acceptable knowledge” and ontology - “the researcher’s view of the nature of reality” (Ibid, p. 119). Some aspects of these assumptions, such as positivism, interpretivism, objectivism and constructivism (Ibid; Bryman & Bell, 2011), are discussed in the following part in order to help the authors determine scientific perspectives for this thesis.

Epistemology

Positivism is an epistemological position that researchers take when working in natural sciences, studying social reality and beyond (Bryman & Bell, 2011). In this position, only events that are investigated produce reliable data, which is then used to confirm the knowledge (Saunders, Lewis, & Thornhill, 2009). Existing theories are deployed to create hypotheses, which are later tested (Ibid). The confirmation of hypothesis leads to the improvement or development of existing theory that may be tested by other researchers afterwards (Ibid). Another aspect of positivism is that the research is organized in an objective way, which the researchers neither affect nor are affected by the studied objects (Ibid).

Another epistemological stance, which takes the opposite position to positivism, is interpretivism (Bryman & Bell, 2011). Interpretivists insist that researchers should understand the difference between human in our roles as social actors (Saunders, Lewis, & Thornhill, 2009). One of the challenges when working with interpretivism is to access social world of the research subjects and understand their own perspectives (Ibid). Within this position, researchers interpret other social roles in their own sets of meaning (Ibid). This is done in the same way as people interpret their everyday social roles with the meaning they bring to these roles (Ibid). Thus, research that betakes the interpretivist approach is constructed socially and subjectively (Ibid). In interpretivist research, the researcher is to focus on the details of the phenomenon (Ibid). It is also stated that interpretivists should reveal the subjective meanings
simulating action of social actors in order to understand the reality behind the details of phenomenon (Ibid).

**Ontology**

*Objectivism* is an ontological position in which social events/entities are described to exist independently from social actors (Saunders, Lewis, & Thornhill, 2009). A research on organizations or cultures may adopt objectivist position since they are considered to be social entities, which exist in reality and are external to social actors (Bryman & Bell, 2011). Even though organizations vary in terms of feature and structure, the term “organization” brings an image of standardized procedures and rules that organizational members have to follow (Ibid). It also creates the sense of hierarchy management where subordinates report to their higher managers (Saunders, Lewis, & Thornhill, 2009). As a social entity, organization forces and rules its members (Ibid). The same can be seen in culture where shared values and customs constrain people in society (Ibid). According to Bryman and Bell (2011), thing which is described under objectivist position has the feature of an object and objective reality.

*Constructivism* is another aspect of ontology, which is considered as an alternative ontological position (Bryman & Bell, 2011). This position suggests that social phenomena and its meanings are continuously created through perceptions and interactions of social actors (Ibid; Saunders, Lewis, & Thornhill, 2009). In other words, social phenomena do not only constrain social actors, but are also continuously revised and established by them (Ibid). As it is stated earlier, rules in organizations are perceived with pre-given characteristics in objectivism (Ibid). Whereas, in constructivism they are perceived as “*much less like commands, much more like general understanding*” (Strauss et al., 1973, p.308) and they are changing and improved by everyday interaction (Ibid). Instead of seeing culture as an external entity that forces social actors, it can be considered that people generate culture continuously (Becker, 1982 cited in Bryman & Bell, 2011). Culture in this sense is perceived as “*continuous state of construction and reconstruction*” (Ibid, p. 23). Regarding the nature of knowledge in social world, constructivism reflects that knowledge is uncertain and socially established.

**Motivation of the scientific perspective choice:**

In this thesis, the authors betake the positivist stance in order to generate acceptable knowledge. The research is organized in an objective way, in which the authors neither
influence nor are influenced by the studied companies. Companies that are chosen for investigation are the only sources used to collect empirical data for this thesis. Within each studied company, three elements of information integration are investigated to provide reliable facts that are later deployed to confirm or generate new knowledge. Regarding ontological viewpoint for the research, the authors adopt objectivist position, since studied companies are considered as external entities. The authors accept the nature of each freight company and terminal operator, and approach them objectively without any constraints in structure. Moreover, when accessing the chosen companies, culture is considered as pre-given value that shapes its members’ spirit. The authors do not take into account cultural changes originated from social actors’ everyday interaction.

2.2 Research strategy

With a clear research strategy, authors have a general orientation in order to conduct their business research (Bryman & Bell, 2011). Research strategy is a plan that covers all the steps from wide assumptions to comprehensive methods of data collection, analysis and interpretation (Creswell, 2014). According to Bryman and Bell (2011), qualitative and quantitative methods are the two strategies used for research. It is noted by Creswell (2014) that these two methods can be mixed in order to integrate two forms of data. However, Bryman and Bell (2011) assert that it is crucial to be careful about integration of these two methods.

Qualitative research strategy emphasizes on words rather than quantification (Berg, 2009; Bryman & Bell, 2011). This approach allows to find and understand the meanings of individuals and groups that are related to a social or human problem (Creswell, 2014). According to Ghauri and Gronhaug (2005), qualitative research is particularly appropriate for unstructured problem and, thus, tends to be exploratory and flexible. In some cases, qualitative research can be applied to test hypotheses, however, the focus is on obtaining insights and building explanations or theory (Ibid). To conduct the qualitative research, authors provide the questions and data that can be collected in the participants’ setting (Creswell, 2014). Furthermore, data analysis can be implemented inductively and researchers can make interpretations of collected data in order to come up with the final report, which has a flexible structure (Ibid). Strategies for qualitative analysis vary, as research starts with existing theory (deductive) or the analysis departs from observations/data (inductive) (Ibid). There are several
techniques that can be considered in order to implement qualitative research such as interview, participant observation, photographic techniques, and historical analysis (Berg, 2009). In addition, with this approach researchers are able to explore processes, activities and behaviors of individuals and groups (Creswell, 2014).

In contrast, *quantitative research* strategy focuses on quantification for data collection in order to form relationship between theory and research (Bryman & Bell, 2011). Furthermore, it adopts positivist perspective and the norms of natural science (Ibid). According to Creswell (2014), objective theories can be tested in order to examine the relationship among variables in quantitative research. These variables can be analyzed by statistical procedures (Ibid). Moreover, Bryman and Bell (2011, p.154) suggest that “measurement provides the basis for more precise estimates of the degree of relationship between concepts”.

**Motivation of the research strategy choice:**

Considering the aforementioned characteristics in both strategies, qualitative research strategy is applied in this research. As the authors tend to investigate three different elements in information integration, interview technique is deployed to collect data from different freight companies and terminal operators. Creswell (2014) states that qualitative research strategy is required in order to explore processes and activities. Therefore, the researchers of this thesis are able to investigate container handling process with the help of qualitative research strategy.

**2.3 Scientific approach**

At the beginning of the research, it is important to be clear about the use of a theory, which later determines the research design (Saunders, Lewis, & Thornhill, 2009). One of the main concerns is whether the research conclusion is drawn from empirical evidence or based on logic (Ghauri & Gronhaug, 2005). Those approaches are respectively known as induction and deduction (Ibid).

With *inductive approach*, research conclusion is extracted from empirical observations (Ghauri & Gronhaug, 2005). With the help of observations, researchers come up with possible findings, which are taken into consideration with existing theories in order to improve or build theories (Ibid). Generally, induction is considered as a process of recording data in order to produce different perspectives of phenomena (Ibid). The outcome of this research approach is theory
Information Integration in Intermodal Freight Transportation (Bryman & Bell, 2011). In details, this process begins with ideas and facts that direct researcher to predictions and theories (Ghauri & Gronhaug, 2005). New predictions and theories guide researcher to new ideas and new facts (Ibid). This cycle is repeated until the researcher reaches new theories that respond purpose of the study (Ibid).

Through deduction, a conclusion is drawn from logical reasoning (Ghauri & Gronhaug, 2005). It is not necessary to be true in reality, however, it requires logical deduction (Ibid). The process of this type of research starts from existing knowledge (Ibid). This knowledge or literature is scrutinized in empirical world to be confirmed or rejected (Dubois & Gadde, 2002). The stage allows researcher to explain or predict and draw the conclusion that responds the research question (Ghauri & Gronhaug, 2005). And the last step involves the revision of theory (Bryman & Bell, 2011). Overall, deduction aims at collecting facts to judge existing theory, which is commonly used to explain the relationships between variables (Ghauri & Gronhaug, 2005). This approach allows researcher to use a theoretical framework, which regulates other processes within the study (Ibid). According to Bryman and Bell (2011), deduction is the most common approach in research conduction, since abstract concepts are defined into factors, which are measurable empirically and quantitatively.

Motivation of the scientific approach choice:

In this thesis, deduction is chosen as the research approach. The authors begin with existing theory of information integration, IFT industry and container handling process in particular. The knowledge of information integration in a supply chain is studied by several researchers. However, there is a lack of research on information integration between freight company and terminal operator (Konings, Priemus, & Nijkamp, 2008; Stahlbock & Voß, 2008). Besides the description of how three elements of information integration (collaboration, information sharing and IT implementation/adaptation) are performed by freight company and terminal operator, this thesis is dedicated to creation of knowledge about the level of information integration between freight companies and terminal operators regarding a research population in IFT. Empirical data from multiple case studies is analyzed in order to investigate the practical issues of the chosen topic. The authors believe that the knowledge gap in this area is filled to some extent, as the findings allow to provide a deep insight into information integration from the dyad perspective.
2.4 Research design

According to Yin (2014), the list of research methods includes experiment, survey, archival analysis, history and case study. The choice of the methods for a particular research lays on the authors of this research, as the methods provide different possibilities to the research depending on its features (Bryman & Bell, 2011). “Doing case study research remains one of the most challenging of all social science endeavors” (Yin, 2014, p.3). Eisenhardt (1989, p.534) defines the case study as “a research strategy that focuses on understanding the dynamics present within single settings”.

According to Yin (2014, p.14), the case study is commonly chosen for cases when investigation tends to answer questions “How” and “Why” regarding “contemporary set of events over which a researcher has little or no control”. Study books on research design, and case study in particular, provide two types of design - single and multiple case studies (Berg, 2009; Bryman & Bell, 2011; Yin, 2014). Dubois and Gadde (2002) argue for the benefits of multiple case study usage, as it usually provides better explanations in the research in comparison with single case study. However, it is important to note that the suitability of the multiple case studies can vary with the field of research and the number of variables included in the investigation (Ibid; Yin, 2014). Herewith, Yin (2014) provides a classification of designs that allows to identify the type of case study design for a particular research. As it is shown on Figure 4 below, there are four types of designs according to number of cases and analysis units: (a) holistic single-case design; (b) embedded single-case design; (c) holistic multiple-case design; (d) embedded multiple-case design. Single-case designs (A and B types) represent research that is built around a single case study, while multiple-case designs (C and D types) are for research with more than one case study (Ibid). Holistic designs (A and C types) include case studies with single unit of analysis (e.g. organization, department within an organization, SC or a SC player, etc.), while embedded designs (B and D types) include case studies with more than one unit of analysis in each case (Ibid).
Motivation of the research design choice:

Yin (2014) suggests that there is no formula for choosing the “correct” case study type for a research design. In this research, the authors use embedded multiple-case study (type D in Figure 4 above) and believe that this research design emerges as the most suitable one regarding the research purposes. The choice of the embedded design, which stands for the multiple units of analysis, allows to approach the investigation of information integration within the dyad perspective. Thus, a terminal operator and a freight company play the role of units of analysis. Additionally, multiple-case study design is used within the investigation. This choice is made in order to enable analysis and gain in-depth understanding of the information integration in IFT and to make conclusions about information integration level within the industry. Herewith, the dyads will be case studies under the research investigation. This research design decision allows the authors to extract information for further analysis and conclusion regarding the information integration within a dyad, based on multiple opinions from the field.
2.5 Sampling

One of the ways to increase the quality of a thesis project is to include an empirical study in the research (Ghauri & Gronhaug, 2005). This method is commonly performed through collecting a sample of the studied population. It means that a researcher chooses a smaller group for investigation from the whole group of studied cases (e.g. organizations, communities, managers, etc.) (Ibid; Bryman & Bell, 2011). In this case, the sample represents the source of knowledge regarding the whole population (Ghauri & Gronhaug, 2005). Sampling procedures are divided in two general categories - *probability* and *non-probability* samples (Ibid; Bryman & Bell, 2011).

*Probability* sample is used when each unit of the research population has an equal chance of being included in the sample (Ghauri & Gronhaug, 2005). This sample category includes different types of sampling techniques, such as *simple random sample*, *systematic sample*, *stratified random sampling* and *multi-stage cluster sampling* (Bryman & Bell, 2011).

*Non-probability* sample is used when it is not possible to clearly define the borders of the research population (Ghauri & Gronhaug, 2005). Thus, non-probability samples do not always fairly represent the research population and its characteristics, as they can provide misleading results (Ibid). However, this category of samples is commonly used in qualitative research (Ibid; Bryman & Bell, 2011; Yin, 2014). Types of non-probability sampling include *convenience sampling* (simply using the cases that are available), *snowball sampling* (a researcher comes across cases that lead to more research cases) and *quota sampling* (sample roughly represents the research population) (Bryman & Bell, 2011).

**Motivation of the sampling method choice:**

In this thesis, the authors use *non-probability sample*. The choice of the sampling method is made in respect with the qualitative nature of this research and high diversity within the research population. The dyad perspective of the information integration suggests 2 populations within the research - the freight companies and the terminal operators. However, the population of this research is narrowed to terminal operators, as the freight company sample is built by means of work with terminal operators with help of snowball method. Further, the authors narrow down the research population by applying certain criteria. These are the modality of the freight operations (intermodal transportation), the type of freight units
used in operation (containers) and terminal size (medium and large size - annual throughput over 500,000 TEU). Hereby, the population of intermodal container ports all over the world reaches 500 units (Rodrigue, Comtois & Slack, 2013). Among those, 110 handle over 500,000 TEU a year (Ibid). The throughput of these 110 ventures responds to the the aforementioned terminal size classification (Fossey, 2007) as medium and large size organizations. Thus, the total population of the research is narrowed down to 110 intermodal terminal operators with focus on container handling (containers appear as the loading units) in medium and large ports.

When organizing the sampling in the study with the dyad perspective on information integration level, the authors approach the transportation chain players that originate in the same chain. From the population of intermodal container terminal operators, the authors extract the research sample by applying the snowball method. In details, the contacts of terminal operators are obtained from the authors’ networks of connection, which is built on “initial contact with a small group of people who are relevant to the research topic” (Ibid, p. 200). Thus, the sample includes terminal operators from the countries of the authors’ origins and professional experiences and consists of terminals in Vietnam, Iran and Russia. Further, the authors gain the contacts of the freight companies that operate in the given terminals. This contacts are suggested by the terminal operators that participate in the research. This approach leads to appearance of the samples of different corporate sizes, different geographical regions and different information integration practices, which the authors perceive as an advantage for the research. Different cases allow to investigate multiple theoretical patterns (Yin, 2014). The research sample is presented in Table 1 below and includes 4 dyads (8 organizations) with 7 interviewees.

Table 1. Research Sample

<table>
<thead>
<tr>
<th>Dyad</th>
<th>Player</th>
<th>Organization</th>
<th>Interviewee</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freight</td>
<td>Orient Overseas Container Line</td>
<td>Ho Minh Trang, Operation</td>
</tr>
<tr>
<td>Dyad 2</td>
<td>“Vietnam BRVTP”</td>
<td>Company</td>
<td>Co. Ltd (OOCL)</td>
</tr>
<tr>
<td>--------</td>
<td>----------------</td>
<td>---------</td>
<td>---------------</td>
</tr>
<tr>
<td>Terminal Operator</td>
<td>Tan Cang Cai Mep International Terminal Co. Ltd (TCIT)</td>
<td>Medium Medium Port - 644,000 TEU in 2013 (Tan Cang Cai Mep Terminal, 2015)</td>
<td>Vo Xuan Bien, MOL’s Operation Representative at the Terminal</td>
</tr>
<tr>
<td>Freight Company</td>
<td>Mitsui O.S.K Lines Ltd (MOL)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dyad 3</th>
<th>“Iran”</th>
<th>Company</th>
<th>Terminal Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Company</td>
<td>Port Operator</td>
<td>Reza Kiani, Port Operator Supervisor</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dyad 4</th>
<th>“Russia”</th>
<th>Company</th>
<th>Terminal Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Company</td>
<td>Port Operator</td>
<td>Kristina Lyshtvan, Terminal Manager</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dyad 4</th>
<th>“Russia”</th>
<th>Company</th>
<th>Terminal Operator</th>
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<tbody>
<tr>
<td>Freight Company</td>
<td>Port Operator</td>
<td>Kristina Lyshtvan, Terminal Manager</td>
<td></td>
</tr>
</tbody>
</table>

Source: composed by the authors

There is an exception for the number of interviewees in dyad 2, as the interviewee for both freight company and terminal operator is Mr. Vo, who works as MOL’s representative at operation office in TCIT terminal. Thus, there is only one interviewee for two players. The interviewee’s responsibility is to coordinate various activities of the terminal operator in order to assure smooth movement of containers at the terminal. In addition, the terminal is partly owned by MOL. Therefore, Mr. Vo (2015) works closely with terminal operator and considers it as another business unit of the company. During the interview, Mr. Vo (2015) ensured that he can provide the information regarding TCIT terminal. He refused to introduce the authors to TCIT employees, since he stated that MOL has a very strict policy for sharing information with independent entities. Hence, even if he had provided contacts to the authors, the information
would be the same as the one he gave. Thus, the authors take an opportunity to investigate a dyad with a terminal operator and a freight company that operate as business units.

2.6 Data collection

Ghauri and Gronhaug (2005; Saunders, Lewis, & Thornhill, 2009) define two types of sources within research - *primary* and *secondary* ones. Secondary sources include data that has been collected within the previous studies and is available when the research is being conducted, while primary data is collected purposely for the research by its authors (Saunders, Lewis, & Thornhill, 2009). Data collection is to include multiple sources of evidence and maintain the chain of evidence during the entire data collection process (Yin, 2014).

**Secondary Sources**

Secondary data includes published and raw materials (little or no data processing) (Saunders, Lewis, & Thornhill, 2009). Among those can be found *documentary* (written and non-written materials), *multiple sources* (area based and time-series based), and *survey* (census, continuous and regular surveys, and ad hoc surveys) (Ibid). Saunders, Lewis and Thornhill (2009) name following advantages of secondary data: (1) may have fewer resource requirements; (2) unobtrusive; (3) longitudinal studies may be feasible; (4) can provide comparative and textual data; (5) it can result in unforeseen discoveries; (6) permanence of data. The authors (Ibid) also name the disadvantages: (1) may be collected for a purpose that does not match your need; (2) access may be difficult or costly; (3) aggregations and definitions may be unsuitable; (4) no real control over data quality; (5) initial purpose may affect how data is presented.

**Primary Sources**

*Experiment, observations* (human and mechanical) and *communication* (survey and interview) are the main sources of primary data in research (Ghauri & Gronhaug, 2005). Primary data collection carries such advantages as its scope, low cost and high speed (Ibid). However, it is also characterized by poor objectivity and precision in comparison with secondary data (Ibid). Yin (2014) presents interview method as the most important source to collect primary data for a case study. Based on the level of formality and structure, interviews are categorized into three types known as *structured interviews, semi-structured interviews* and *unstructured* or in-depth interviews (Saunders, Lewis, & Thornhill, 2009; Bryman & Bell, 2011). The first type uses
standardized questions to collect quantifiable data, which is commonly recognized as quantitative research interviews (Ibid). The second type allows researcher to have a list of themes or questions (Ibid). However, a number of questions can be excluded in a specific interview depending on particular organizational context (Ibid). The last type refers to an informal way of interview, according to which a researcher aims at exploring studied areas in depth (Ibid). The interviewers are aware of what they intend to explore, and thus, it is unnecessary to have pre-planned questions in this situation (Ibid). Instead, the interviewees can freely present events and behaviours to the related topic (Ibid). Herewith, it is the interviewee’s perception that leads the interview (Ibid). Regarding the interview conducting methods, face to face, telephone and computer-assisted interviews are the common ones to approach interviewees (Ibid; Yin, 2014). Face to face technique is commonly used in qualitative study. It suggests a setting where respondents stand or sit in front of the interviewer while responding to a list of questions (Bryman & Bell, 2011). By using a telephone interview, researchers can limit the influence of their appearances or presences on the respondents’ answer (Ibid). However, the quality of information may be low due to poorly articulated questions, response bias, inaccuracies resulting from poor recall, and reflexivity (Ibid). Moreover, telephone interview needs to be relatively short since respondents become impatient and distracted over a long time on the telephone (Ibid). With computer-assisted interviewing, the Internet and email communication are utilized to contact interviewees who are located far from interviewers, as well as cope with money and time restriction (Ibid). Each technique has its advantages and disadvantages. Thus, in accordance with the aim of the interview, the researcher makes a decision regarding the interview type and technique that are to be performed (Ibid).

Motivation of the data collection method choice:

This research includes both types of data sources - primary and secondary. As it is suggested by Yin (2014), the investigation begins with literature review. Thus, secondary sources are used in order to extract and present the existing knowledge regarding the IFT industry and container handling, the information integration concept and its elements. Multiple area based data sources, such as books and journals, become the main sources of the secondary data in this research. Further, interviews are conducted within the frame of multiple case studies. Primary data is included in this research according to findings of interviews. According to Bryman and Bell (2011), qualitative research with multiple case studies requires certain
structures to ensure comparability between cases. Flexibility is required when approaching different organizations (Ibid). In this thesis, different requirements are taken into account. Therefore, among different types of interview, the authors consider semi-structured interviews as the appropriate technique for primary data collection. As the investigated freight companies and terminal operators are located in various geographical regions, face-to-face interviews appear as a costly technique. The authors choose computer-assisted interviewing, which utilizes the Internet and email communication for this thesis. Skype is the application that is used to interact with respondents. Telephone is also used for communication when being preferred by interviewees. In order to optimize those methods, the authors provide interviewees with the list of questions in advance through email. This allows respondents to have enough time for research and preparation of answers. In this combination of methods, the authors are able to take advantages of the method and minimize its disadvantages. With the preceding introduction to the questions, interviewees have an idea on what he/she is going to respond during the interview. Thus, they are not influenced by the authors’ characteristics, presence and subjective feelings. Also, this method avoids misleading answers as any misunderstanding of the questions is clarified during the interview.

2.7 Data analysis

The main procedure of the data analysis within a research is the data manipulation, which allows to make sense of the collected information with the help of interpretation (Ghauri & Gronhaug, 2005). Yin (2014) suggests that in order to build an analysis of a decent quality, a researcher is to consider following principles: (a) the researcher refers to all available evidence; (b) the analysis addresses all the plausible rival interpretations; (c) analysis addresses the most significant aspects; (d) use of prior expert knowledge. The analysis itself is to enrich the understanding and construction of explanations within the research (Ghauri & Gronhaug, 2005). According to Yin (2014), there are five analytical techniques when working with data. These are presented below.

*Pattern matching*, which implies comparison of patterns within data from theoretical and empirical studies. Research can be approached with an intention of new patterns’ investigation. Alternatively, if patterns are provided by a theoretical study, it can be approached by testing
these patterns during analysis. The method allows to increase an internal validity of an empirical study.

Explanation building, which appears as a kind of pattern matching. Within an explanation building, a researcher investigates a case study in order to build an explanation about the case. Commonly, this type of analysis appears in research in a narrative form in order to explain a phenomenon.

Time-series analysis is a technique that implies conducting analysis through experiments and quasi-experiments. The analysis can be performed with the help of simple time series, complex time series or chronological sequences. The goal of an analysis is to investigate the “How” and “Why” within the chain of events that take place over time.

Logic model prescribes matching the events that are observed within an empirical study with theoretically predicted events. In this way, the model appears as a technique that is similar to pattern matching. According to the author (Ibid), the technique can be applied within various dimensions of analysis and with different purposes, which makes it distinctively complicated.

Cross-case synthesis is an analytical technique that is often used for a multiple-case study research, as it allows to increase the value of the research findings. The common procedure prescribes individual investigation of every chosen case study followed by aggregation of the findings. Thus, all the case studies are approached as an individual unrelated matters.

Motivation of the analysis strategy choice:

Data analysis emerges as a challenging task for a research that includes the case study method as a source of primary data (Eisenhardt, 1989; Yin, 2014). In this thesis, the authors betake the cross-case synthesis technique. The choice is motivated by the multiple-case study research design that is used in this research. Cross-case synthesis allows to investigate the three elements of information integration within the individual studied cases and draw conclusions regarding the theoretical finding extracted from case studies. Thus, the analysis starts with within case analysis, where the authors review and analyze the information collected in each case study. This step is carried out in order to evaluate the information integration level between a freight company and a terminal operator within each dyad. Further, the cross case analysis is performed in order to investigate the level of information integration and its three
elements regarding the defined population within the IFT, which is extracted from four studied dyads. The technique empowers the researchers to come up with a knowledge that can partly fill in the theoretical gap of information integration level within the chosen industry.

2.8 Research quality

Within a research it is necessary to provide readers with relevant information that enables the evaluation of this research procedures and its outcomes (Eisenhardt, 1989). According to Saunders, Lewis and Thornhill (2009), it is essential to consider two major aspects in order to reduce the possibility of coming up with unreliable research findings. These are the validity and reliability (Ibid). Furthermore, it is important to contemplate reliability and validity in the qualitative research (Ghauri & Gronhaug, 2005). Bryman and Bell (2011), and Yin (2014) point out that validity and reliability should be presented in order to assess a business research.

**Validity** is referred to the issue of whether the findings are really about what they appear to be about (Saunders, Lewis & Thornhill, 2009). There are three kinds of validity that are defined as internal validity, external validity, and construct validity (Yin, 2014). Internal validity is mainly regarded to explanatory case studies (Ibid). In other words, researchers attempt to investigate and define how event X can lead to event Y in explanatory case studies. However, this method is not applicable for case studies (Ibid). Unlike internal validity, external validity illustrates a problem in a way that enables researchers to utilize case studies and small samples (Ibid). With external validity, it is required to look at the original research questions as it allows researchers to generalize findings across social settings (Ibid). Furthermore, it is essential to use “how” and “why” in research questions in order to generalize the findings and seeking for external validity when conducting case studies. Construct validity refers to specific concepts that are used in the research and related to the main objectives of the research study (Yin, 2014). This means that construct validity can be supported by referring to the scientific sources, such as published studies, that present the studied phenomenon in same way (Ibid). Authors should consider certain techniques in order to increase the construct validity (Ibid). The use of multiple data sources during the data collection is an example of such a technique (Ibid). Other examples could be a submission of a draft case study to participants in order to review it and confirm the information accuracy (Ibid).
Researchers consider *reliability* in order to minimize the errors and bias in the research (Yin, 2014). The aim of the research reliability is to make sure that if other researchers pursue the same procedure according to the original research, they should be able to come up with the same results (Ibid). It is suggested to document the procedures and provide the data collection guidelines that are to be followed by authors in each case study (Ibid). These steps are meant to enable the replication of the same result by other researchers (Ibid).

**Motivation of the Research quality in this thesis:**

Validity is highly considered in this research by peer-reviewed sources that endorse the theoretical background. The authors examine multiple case studies to compare the findings with theories in order to have a constructive validity, as being explained in this research. Furthermore, the research paper is submitted to the interviewees for reviewing and approving the factual information that is included in the research. Regarding reliability of this thesis, it is essential to contemplate two elements of information integration, which are IT implementation and adaptation, and information sharing since they are strongly connected to technology changes. Likewise, Hagspiel, Huisman, and Nunes (2014) explain that due to global competition and technology changes, managers have to consider technological innovation process together with the relevant information sharing. In this regard, studies executed in this area do not necessarily have to show similar conclusion and outcomes. Therefore, internal validity is not considered in this paper.

**2.9 Ethics in Research**

According to Saunders, Lewis, and Thornhill (2009), research ethics refer to how researchers formulate and define the research topic, research design, data collection, data storage, data analysis and sum up the findings in a moral and liable way. There is a number of issues arise as ethical concerns during the research, such as privacy of participants, permission and possible fraud of participants, conservation of the confidentiality of the collected data, reaction of participants, and objectivity of the researcher (Ibid; Bryman & Bell, 2011). Regarding participants’ privacy, Saunders, Lewis and Thornhill (2009) suggest that agreements between individual/organization and researchers have to be established during the study. For example, investigators have to keep in secret participant personal information, such as names, addresses, phone number and confidential data of organization, if being requested (Ibid). In a research,
any action of using information on people without their agreements is considered a violation of privacy, which leads to research’s failure on ethics (Ghauri & Gronhaug, 2005). In some cases, researchers do not reveal the whole truth of the study purpose, which may cause participant’s refusal to attend or reluctance to cooperate. Participants have to have the right to know the real purpose of the research in order to be able to make their own decision regarding the research participation (Ibid). In addition, authors must respect participants’ right of withdrawing partially or completely from the study (Saunders, Lewis & Thornhill, 2009). A researcher is encouraged to avoid causing professional and personal harm to the providing individual, when establishing the contact and collecting data with the participants help (Ibid). This suggestion is particularly fair for a study that carries unpredictable results, as researchers have to guarantee that the findings would not embarrass or disadvantage anyone who provides the information (Ghauri & Gronhaug, 2005). Moreover, observations, interviews and questionnaires may stimulate discomfort or stress for participants (Saunders, Lewis & Thornhill, 2009). Therefore, researcher’s approach should release this kind of anxiety to a highest possible degree (Ibid).

Another general ethical consideration, which determines quality of the study, is the researcher’s objectivity (Ibid). When collecting data, authors should avoid subjective selection and record information precisely and completely (Ibid). Any subjective generation of data is inadmissible and regarded as unethical (Ibid). During studying process, authors have to honestly report the research’s outcomes, as well as the methods and techniques used in order to provide the readers with decent reliability of the results (Ghauri & Gronhaug, 2005). Finally, it is the researcher’s responsibility to provide the final report to participants in order to let them see how provided information is used and whether all the consensuses are remained (Ibid).

**Ethical considerations in this thesis:**

Due to ethical consideration within this thesis, the authors discuss with participants the matters of participants’ privacy and authors’ responsibilities. Thus, certain agreements are established and followed during the study. Before interviewing, participants are introduced to the purpose of the paper and the studied concepts of three information integration elements within IFT. The interview questions are formulated in the way that explores the information integration in every case study without creating unsecured feeling for the respondents. The authors also respect the truth by presenting real empirical data received from participants. In every process of the study
from design to data collection, analysis and reporting, the authors always keep in mind objective approach to show the fact precisely and reliably. In the end, participant companies have the right to access the final report of this thesis so that they can examine the accuracy of the provided information. In addition, they can apply some useful recommendations from the paper or simply update new aspects of information integration in IFT.

2.10 Summary of methodology

For the research the authors choose positivist scientific perspective, qualitative research strategy and deduction approach. The methodology involves snowball sampling method and embedded multiple case studies. The authors use multiple area data sources and semi structured interviews as a method of data collection. The analysis is performed with help of cross-case synthesis method. Reliability, validity and research ethics are also taken into consideration. Table 2 below shows the methodological approaches that are executed in this research.

<table>
<thead>
<tr>
<th>Sub Chapters</th>
<th>Research Decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Scientific Perspective</td>
<td>Positivism</td>
</tr>
<tr>
<td>2.2 Research Strategy</td>
<td>Qualitative research</td>
</tr>
<tr>
<td>2.3 Scientific Approach</td>
<td>Deduction</td>
</tr>
<tr>
<td>2.4 Research Design</td>
<td>Embedded multiple case study</td>
</tr>
<tr>
<td>2.5 Sampling</td>
<td>Non-probability: snowball sampling</td>
</tr>
<tr>
<td>2.6 Data Collection</td>
<td>Secondary sources: Multiple area based data sources</td>
</tr>
<tr>
<td></td>
<td>Primary sources: semi-structured interview assisted by Internet and email communication.</td>
</tr>
<tr>
<td>2.7 Data Analysis</td>
<td>Cross-case synthesis</td>
</tr>
<tr>
<td>2.8 Research Quality</td>
<td>Reliability and Validity</td>
</tr>
<tr>
<td>2.9 Research Ethics</td>
<td>Participants’ privacy and researchers’ ethical responsibility.</td>
</tr>
</tbody>
</table>

Source: composed by the authors
Chapter 3. Introduction of IFT and its players

In chapter 3, general description of the studied objects is presented to the reader. Extraction of information regarding containers and containerization, players within the chain and container flow is dedicated to providing the reader with overall understanding of the industry. Hereby, the reader easily perceives the information given in the following theoretical chapter.
3.1 Containers and Containerization

The container was first introduced in shipping industry in the late 1950s and considered as the most important change to improve efficiency in cargo handling (Laine, 2005; Lowe, 2006; Hanssen, Mathisen, & Jørgensen, 2012). Containerization has improved the level of customer service by reducing the delivery time, eliminating the risk of cargo loss/damage and saving the cost of packaging (Hanssen, Mathisen, & Jørgensen, 2012). The evolution of containerization is the main factor that contributes to the development of intermodal transportation industry (Ibid). The introduction of standardized (ISO) container, which is applicable in several transportation modes such as railroad, road and maritime, supported the development of transportation industry (Ibid). At the same time, standardized containers evolve into different dimensions of length, width and height in order to meet specific good requirements and appeal new cargoes (Laine, 2005). TEU (twenty-foot equivalent unit) and FEU (forty-foot equivalent unit) and the types of containers that are used most frequently (Lowe, 2006; Carlo, Vis, & Roodbergen, 2014). The industry also provides its players with variety of container types that differ by size and purpose (Levinson, 2010). Thereby, standard container, high cube container (taller in comparison with standard containers), hard top container (steel removable roof), open top container, refrigerated container, bulk container (with three loading hatches on the roof), tank container (inbuilt cistern for liquids), platforms and other types of containers are available to serve the freight transportation efficiently (Ibid).

Due to the high volume of cargo transported and growing congested roads, IFT is the new focus for all players in the transportation industry (Ibid; Hanssen, Mathisen, & Jørgensen, 2012). It utilizes the strengths of different means of transportation into one integrated chain, thus increases the overall performance (Taylor, & Jackson, 2000). In details, IFT takes advantage of the accessibility of truck for short distance and the large capacity of train and ship for long distance. In that way, IFT becomes very competitive in freight transportation exceeding 500 miles (Ibid). According to Caris, Macharis and Janssens (2013), IFT is considered as a new mode in transportation industry and a sustainable transportation system for the future. Since the combination of different means of transportation involves different operators with multiple decision makers, each kind of transportation modes should not operate
separately (Ibid). In other words, they should integrate their actions along the transportation chain (Ibid).

### 3.2 Players within a transportation chain

#### 3.2.1 Freight Company

“Freight companies are responsible for the carriage of goods and/or associated services on behalf of a shipper” (Rodrigue, Comtois & Slack, 2013, p.329). Freight companies can cover broad variety of scopes such as intercontinental, national, and local (Coyle et al., 2011). One of the essential elements of freight companies is time constraint, which implies that they can arrange the service ranging from express where time is critical, to the feasible lowest cost where time is secondary (Rodrigue, Comtois, & Slack, 2013). Another element is consignment size, which determines different types of loading such as full load, partial load, and parcels (Coyle et al., 2011; Rodrigue, Comtois, & Slack, 2013). Regarding transportation mode, “cargo can be carried out on a single mode (sea, rail, road or truck) or in a combination of modes through intermodal transportation” (Rodrigue, Comtois, & Slack, 2013, p.205). Service characteristics of freight companies include transit time, reliability, accessibility, capability, and security (Coyle et al., 2011).

#### 3.2.2 Terminal

Terminals occupy specific areas, normally with compelling requirements and appropriate equipment (Rodrigue, Comtois & Slack, 2013). The large number of containers can be stored in this place and one of the key factors of container terminal is its capability to efficiently stack the considerable number of containers (Stahlbock & Voß, 2008). High productivity of container handling and cost-effective services are also significant factors that terminal operators should consider in order to compete with other terminals (Ibid). Furthermore, they have to invest heavily in appropriate equipment for faster service and superior quality (Ibid; Rodrigue, Comtois & Slack, 2013). In order to utilize terminals, decisions of the number of terminals and location of terminals should be considered (Ibid). Getting closer to the customer can enhance the level of service given to that customer (Ibid). Hoshino (2010) explains that enormous market, empowered by leading suppliers of terminal services, is affected by the size and the number of terminals. He (Ibid) also discusses cases of horizontal integration among
terminals, which clearly benefits the information integration process within the transportation chains. However, this thesis is dedicated to vertical integration within a SC and, hereby, the cases of horizontal integration will not be discussed further.

3.2.3 Terminal Operator

According to Rodrigue, Comtois and Slack (2013), there are different types of governance in terminals, which shape modes of financing, operations, functioning, and external relationships. Ownership and operations are two main elements of terminal governance (Ibid). Each of these elements is divided in two parts, which are private and public authorities (Konings, 2008; Rodrigue, Comtois, & Slack, 2013). In public ownership, because of the economy and strategic importance, most of the terminals are owned by public authorities who provide the investment in infrastructure and suggest future expansion using public capitals (Ibid). In contrast, private ownership uses private capital (Ibid). Operation concerns with day-to-day management and control the terminal activities (Ibid). Public operations are common in many ports, and in some cases, private companies can operate with publicly owned facilities under an official permission (Ibid). The concession for each company is different in terms of duration and conditions. For instance, short-term concession is for a few years and long-term one is between 15 to 30 years (Ibid). In other cases, private companies have to invest in equipment (Ibid).

3.3 Container flow

IFT utilizes the flexibility of road transportation, the long distance of maritime and railroad transportation, and terminals that connect the transportation modes (Flodén, 2007). According to Hanssen, Mathisen and Jørgensen (2012), IFT network includes three sub-processes, which are known as pre- and post-haulage (PPH), intermodal terminals and long-haul shipment. These processes are demonstrated on Figure 5 and described further.
Figure 5. Container Flow in a Transportation Chain

Pre- and post-haulage (PPH)

Pre- and post-haulage of IFT chain refer to the process of pickup and delivery of containers between customer locations and intermodal terminals (Bergqvist & Behrends, 2011). In details, pre-haulage involves the transportation of an empty container to a forwarder, which is an entity specializing in arranging storage and shipment on behalf of its customers. Afterwards, the container, which is full of cargo, is transported to the intermodal terminal (Hanssen, Mathisen, & Jørgensen, 2012). On the other hand, post-haulage implies the distribution of a full container from an intermodal terminal to a receiver and the return of the empty container to the terminal (Ibid). In this process of PPH, road mode is often used to collect and distribute the goods (Ibid). Most PPH transportation around the terminals is operated at the distance of 0-25 km or up to 100 km in some cases (Caris & Janssens, 2009). The road segment accounts for large proportion of IFT cost (Ibid). Therefore, by operating this process more efficiently, the attractiveness of using IFT can be improved (Ibid).
2. **Intermodal terminals**

In the classification of the transportation chain processes, Hanssen, Mathisen and Jørgensen (2012) refer to intermodal terminals as the link between PPH and long-haul shipment. Intermodal terminals are the ground for the terminal container handling processes, where freight companies and terminal operators physically meet and interact (Ibid). Intermodal terminal processes vary according to cargo volume, terminal location, handling equipment used, types of mode served, etc. (Ballis & Golias, 2002). The terminal processes and their order scheme are designed in a way that avoids bottlenecking (Stahlbock & Voß, 2008; Carlo, Vis, & Roodbergen, 2014). The standard container handling process within an intermodal terminal includes container uploading/unloading, container transport to the terminal, containers stacking, container transport inside the terminal and other modalities (additional operation that may vary from terminal to terminal), accordingly with Figure 6 below (Carlo, Vis, & Roodbergen, 2014).

Figure 6. Container Handling inside an Intermodal Terminal

![Figure 6. Container Handling inside an Intermodal Terminal](source)

Source: adapted from Carlo, Vis, & Roodbergen, 2014.

3. **Long-haul shipment**

The transportation from terminal to terminal is named as long-haul shipment, which predominantly uses modes of rail, inland waterways, short sea shipping or ocean shipping (Macharis & Bontekoning, 2004; Hanssen, Mathisen, & Jørgensen, 2012). This process applies for long distance transportation where containers are gathered to achieve the economies of scale (Bergqvist & Behrends, 2011).
Chapter 4. Theoretical Study

This chapter presents the theoretical study conducted by the authors. The chapter includes information regarding the theoretical concepts that are studied and used further in the empirical study. The authors present the data extracted from research on information integration in a supply chain and within intermodal freight transportation.
4.1 Information Integration

4.1.1 Information Integration in a SC

According to Lotfi and Shahnorbanun (2013), a supply chain can be perceived as a stream of three flows - material, financial and informational, whereas the last one commonly appears as the least covered theoretically and practically. Therefore, the information integration concept calls for attention within supply chain studies (Ibid). Primarily, this statement is fair due to globally increasing competitiveness and demand for customer value (Ngai et al., 2011; Lotfi et al., 2013). Information integration as a tool of the SCM ties processes within logistics management, transportation management, strategic planning, warehousing, inventory management, manufacturing, supplier management, and customer management, as every process within an integrated supply chain is enhanced by information flow (Marinagi, Trivellas & Sakas, 2014). According to Bagchi and Skjoett-Larsen (2003) information integration in a SC can take form of technology exchange, resource and risk sharing, and information exchange regarding process management, planning/control, design and development. The integration is achieved once the partners in SC fulfill following requirements: 1) using compatible systems and procedures for information sharing; 2) linking computer information systems and using same communication technologies (EDI, XML, RF, etc.); 3) pooling resources among SC partners; 4) collaborative planning, forecasting and replenishment; 5) CAD/CAM (software tool); 6) learning from one another (Ibid). As it is stated in the background (referring to chapter 1), the authors approach the information integration concept and its three elements in accordance with the provided definition.

Spekman, Kamauff and Myhr (1998 cited in Forslund & Jonsson, 2007) and Bagchi and Skjoett-Larsen (2003) distinguish three levels of information integration. The low level of integration is signified by no collaboration, stage of collaboration negotiation or poor collaboration (Ibid). Medium level of information integration stands for cooperation with few suppliers within the SC and introductory or medium level of IT adaptation among integrating partners (Ibid). High level is characterized by high collaboration, joint planning, IT application and active information sharing (Ibid). It is important to note that the three levels system describes information integration in a general SC, whereas in this research authors take focus on transportation chains with dyadic perspective.
4.1.2 Information Integration in IFT

According to SteadieSeifi (2014), IFT provides a platform for increasing efficiency, reliability and flexibility in freight transportation industry. As freight company and terminal operator are the two main players involved in IFT operations, the interaction of information sharing, IT and collaboration between these players plays an important role in ensuring a smooth transportation system (Caris, Macharis, & Janssens, 2013; Talley, 2014). Improvement in these three elements of information integration increases data flow, on time transportation, quality of information and leads to the possibility of collaborating real time operations among players (Crainic & Kim, 2006; Talley, 2014). Consequently, it enhances the quality of the services provided within the transportation chain (Ferrari et al., 2010). When three elements of information integration are synchronized, it minimizes the cost and maximizes the profit of the transportation chain (Talley, 2014). Caris, Macharis and Janssens (2013) state that research on information integration of IFT, as well as between freight company and terminal operator in particular, is considered as young field, which offers many opportunities and challenges for researchers to investigate.

4.2 Information Integration Elements

4.2.1 Collaboration

4.2.1.1 Collaboration in a SC

Relationships between actors of a supply chain have been thoroughly discussed in academic and professional literature (Verdonck et al., 2013). Due to increasing attention to SC collaboration, authors discuss various types of collaboration between SC players (Ibid). Vertical and horizontal collaboration, which can be also referred as cooperation, are commonly used for description of SC collaboration dimensions (Ibid). The vertical collaboration perspective is taken for this research. Vertical collaboration can be defined as cooperation between two or more firms that are allocated on the different levels within one SC (Leitner et al., 2011). The same definition is used by the authors when applying the collaboration concept in research of transportation chain and container handling processes.

When it comes to information integration, collaboration is required to encourage the willingness of information sharing and communication between the partners in a SC (Koçoğlu
Collaboration capability of the SC actors defines the level of information sharing quality (Adams et al., 2014). According to Sandberg (2005), collaboration includes two core aspects - the relationship between the involved parties and the processes that take place when performing collaboration. In practice, collaboration can appear in a SC in a form of processes like development of goal congruence, forecasting, capacity planning, planning of inventory cycles, replenishment and cooperation in promotional strategies among the members of the SC (Ibid; Kalyar et al., 2013). By its definition, collaboration includes two or more SC parties that are involved in the collaboration (Gonzalez-Feliu, 2013). It can be noted that due to the dyad perspective in this research, collaboration is presented as an element of information integration that includes two decision-makers - a freight company and a terminal operator. Ireland and Crum (2005) describe a circle of phases that represent collaboration phases in a SC:

- **Agree.** At this phase, players decide and agree on when and how to collaborate. At the same phase, players discuss improvements and benefits that will be gained from collaboration.
- **Execute.** The collaborating players measure and monitor collaborative result. This phase results into enabling of a continuous improvement.
- **Educate.** At this phase, the players study the business process flow and review the plan execution.
- **Share.** This stage is the last one in the circle and, at the same time, appears as source of information and decisions for the beginning of the new collaborative circle. The players work with information and knowledge, and decide what, how, when and with whom to share.

Collaboration in a SC is commonly associated with trust (López-Navarro, 2013). In practice trust and collaboration commonly come together as their goals cross on the idea of providing the SC with a competitive edge (Kalyar et al., 2013). Unlike collaboration, trust is a notion that cannot be established by a decision of collaborating units within transportation chain, as in practice it requires time and multiple collaborative events (Ferrer et al., 2010).

### 4.2.1.2 Collaboration in IFT

The collaboration concept within the IFT is commonly studied on the dimension of horizontal cooperation, while collaboration along the SC appears to attract less academic attention
Information Integration in Intermodal Freight Transportation

(López-Navarro, 2013). Researchers (Hadaya & Cassivi, 2007; Li, Negenborn, & De Schutter, 2014) note that collaborative planning enables the company to increase its performance efficiency within a transportation chain, which determines the necessity of collaboration among the players of the chain.

Hadaya and Casivi (2007, p. 960) suggest that “joint collaboration planning actions assure information visibility between the partners by identifying, clarifying and establishing the information exchange characteristics (data, processes and systems) required to support the collaboration processes that will ensue”. Joint planning, as the key component of the efficient collaboration, is aimed at benefiting all the parties involved in container handling process (Johnson & Kristal, 2008; López-Navarro, 2013). Collaboration between players within a transportation chain means to decrease uncertainty within the chain and provide reliable services, time and cost efficiency as well as strengthen relationships among parties (López-Navarro, 2013). In comparison with horizontal collaboration, the vertical one involves fewer risks, however, there are various barriers that are known (Ferrer et al., 2010). Herewith, one of common issues known is the low recognition of collaboration benefits among freight companies and terminal operators, which leads to a situation where information sharing, joint planning and IT integration are not implemented and used in practice to their full capacity (Ibid; Kuo & Miller-Hooks, 2012; López-Navarro, 2013; Goerlandt & Montewka, 2015). Another reason that can be mentioned is a lack of trust between players along the transportation chain, which is directly related to the quality of relationships and communication (Ferrer et al., 2010; López-Navarro, 2013).

López-Navarro (Ibid) suggests that practical aspects of collaboration require more time and efforts for the terminal operators than freight companies. This notion emerges as a result from terminal operators’ role of a link within a supply chain (Ibid). The intermodal terminals are commonly served as a link between multiple freight companies that represent different transportation modes (Ibid).
4.2.2 Information Sharing

4.2.2.1 Information Sharing in a SC

The element of information sharing appears in research as the most recognized component of information integration (Lotfi et al., 2013). Some researchers refer to information sharing as the information integration itself (Ibid). The advantages of information sharing are emphasized in research as the center of supply chain coordination (Min et al., 2005; Lotfi et al., 2013). Therefore, the demand for information sharing is obvious for partners operating in the supply chain as it allows to maintain their competitive advantages (Min et al., 2005). In a long-term perspective, an increasing level of information sharing decreases total cost and inventories, as well as it improves the operational performance within the supply chain (Min et al., 2005; Zhou & Benton, 2007). Moreover, when information is accessible within a supply chain, partners can promptly and proactively react to sudden changes from the market by adjusting their business plan or formulating new ones (Lee & Whang, 2004; Fiala, 2005). According to Lotfi et al. (2013), information sharing also allows players in supply chain to increase their knowledge base. As companies are increasingly aware of information sharing benefits, attention is drawn to the effort of sharing and obtaining information through the value chain (Koçoğlu et al., 2011). It is apparent that accumulative knowledge and other benefits from information sharing stimulate firms to work towards the goal congruence (Ibid). According to Sandberg (2005), information sharing can be triggered by the collaboration activities, once the partners agree to share information regarding the inventory levels, sales data, order statuses for tracking and tracing, sales forecasts, production/delivery schedule and performance metrics.

4.2.2.2 Information Sharing in IFT

The importance of operational visibility within transportation chains increases due to the unstable market, technological development and the growing number of players involved in the logistics flow (Sternberg, 2008). Operational visibility within a transportation chain, to some extent, implies information sharing as well as transparency with the support of various information technologies (Lumsden & Stefansson, 2007). Within transportation industry, transportation visibility along the cargo flow is prerequisite for utilizing time and volume (Sternberg, 2008). In order to have a seamless flow of cargo, a model of information sharing, which maps the flow of information, is required and should be accepted by all the participants.
involved (Ibid). The ability to achieve a cost efficient transportation depends on how the information is organized and shared along the chain (Dürr & Giannopoulos, 2003; Hanssen, Mathisen, & Jørgensen, 2012). For instance, the lack of information can cause problems for freight companies when optimizing a loading plan and updating shipping information, such as changing in schedules (Sternberg, 2008; Guo et al., 2014).

When it comes to IFT, the complexity of involving several modes of transportation raises the importance of information interaction and sharing between parties that operate within the chain (Dürr & Giannopoulos, 2003). It is common that not all the necessary information is accessible for all the participants since companies are not willing to share the data to avoid the risk of disclosing their competitive advantage (Eatough, Brich, & Demetsky, 1998; Caris, Macharis, & Janssens, 2013). Different operators provide the data on the goods’ location and the status of goods with different formats along the route (Ibid). This is a result of incompatible information systems, different managerial capability and distinguished volume of data exchanged (Hanssen, Mathisen, & Jørgensen, 2012). Therefore, in order to trace the good, one has to communicate with several freight companies and terminal operators (Dürr & Giannopoulos, 2003). Even if the information is obtained, it is still problematic to interpret and decide whether it is important or not (Ibid). Consequently, there is an increasing concern regarding the harmonizing of all the information along the chain into one format (SteadieSeifi, 2014). According to Dürr and Giannopoulos (2003), the process of information sharing along IFT chain is categorized into four distinct stages, which embrace data collection, data processing, information dissemination and information use.

1. **Data collection.** In this stage, data is collected in accordance with specific orders, which shows the content of information transferred along the transportation chain (Ibid). This data can be collected through various means of technology such as tracking and tracing equipment, global positioning system, electronic tags (RFID) or simply entering the data into the system manually (Ibid).

2. **Data processing.** The raw data, which is collected from different sources through many means of technology, is analyzed (Ibid). The result of this process provides meaningful information that can be used by players within the chain (Ibid).
3. **Information dissemination.** In this stage, useful information becomes available and is circulated to the players in the chain (Ibid). It can be conducted through service providers (Ibid). A number of communication methods are used to communicate with partners. E.g. phone, email, fax, automatic electronic exchange of data, XML links (Ibid)

4. **Information use.** The generated information is used by participants who need it at this stage (Ibid). It can be used as an input for company’s office application or individual record of information (Ibid).

Nowadays many enterprises in IFT exploit EDI (Electronic Data Exchange) in order to exchange information in a more effective way (Fujii, Egami, & Shimizu, 2014). According to Lee et al., (2015) enterprises can exchange information through EDI with standard electronic formats in a timely manner. Apart from EDI, some companies have implemented Intranet, which is web-enabled technology within an enterprise that allows employees to use the same browser to access company’s data for information sharing (Baker, 2000). On the other hand, Extranet as a web application is used for the enterprise's suppliers, trading partners, clients, and marketers, in order to access the internal corporate information (Ibid). Furthermore, with the advent of the Internet, companies of different sizes can communicate with their partners and exploit EDI to its full capacity (Stefansson, 2002).

### 4.2.3 IT implementation and adaptation

#### 4.2.3.1 IT implementation and adaptation in a SC

Nowadays IT techniques and innovations are considered as a new competitive advantage that can increase success rates of a particular organization and the whole supply chain (Marinagi, Trivellas, & Sakas, 2014). By investing in an advanced IT system, organizations do not only control their supply chain better, but also enable a seamless information sharing along the supply chain (Ibid). An exchange of large volume of information and/or complex information can be facilitated through an IT system (Prajogo & Olhager, 2011). Moreover, just-in-time information, which is provided by advanced IT systems, enables organizations to align their activities with their partners (Ibid). As a result, one can expect a better cooperation within the whole supply chain (Ibid). Since IT becomes crucial in creating competitive edge for firms, diverse technologies are developed for facilitating supply chain management including
information sharing (Ibid). Examples of the systems are Business-To-Business communication, Business-To-Business private (Ethernet), Electronic Point of Sale, radio frequency identification (RFID), extensible markup language and Web services (Ngai et al., 2011; Prajogo & Olhager, 2011). However, it will be insufficient to mention IT implementation without IT adaptation. One of the greatest obstacles of the SC integration is the difference of IT systems that are used by partners (Bagchi & Skjoett-Larsen, 2003). Hence, it is important to align IT application, goals and strategies among players (Marinagi, Trivellas, & Sakas, 2014). When different systems of IT are modeled in one common structure, information flow will be smooth, the level of ambiguity will be decreased and final products will reach customers in shorter time (Fiala, 2005; Lotfi et al., 2013).

4.2.3.2 IT implementation and adaptation in IFT

Collaboration between a freight company and a terminal operator implies the requirement of goal congruence development and efficient decision-making (Caris, Macharis, & Janssens, 2013). In this regard, IT can play an important role for daily operations and exchange of real-time data with help of available software and hardware (Ibid). IT implementation can boost the communication between the IFT players, enable high level of security and increase efficiency of transportation operation (Andziulis et al., 2012). Due to a high number of actors involving in IFT, who is required to integrate different modes within container handling processes (Marchet, Perotti, & Mangiaracina, 2012), it is essential to organize the information exchange via IT (Ibid). With help of IT implementation, freight companies and terminal operators can acquire mutual advantages (Harris, Wang, & Wang, 2015). Advanced operation system enables terminal operators to reduce the loading and unloading time, enhance the utilization of terminal infrastructure, reduce the costs, and improve the customer satisfaction (Ibid). On the other hand, freight companies can enhance the operation efficiency, improve the utilization of transportation infrastructure, decrease the empty container runs by having a better route scheduling, and increase the customer satisfaction (Ibid). However, there are certain barriers that stand in the way of IT implementation and adaptation within transportation chains (Caris, Macharis, & Janssens, 2013; Harris, Wang, & Wang, 2015). The size of enterprises plays a significant role in IT implementation and adaptation, as medium and small size companies have constraints such as financial aids shortage, limited human resources, already implemented IT, and lack of training and education among employees (Harris, Wang, & Wang, 2015).
Moreover, incompatibility of IT systems between freight companies and terminal operators can lead to significant issues along the transportation chain, as information exchange is significantly more complicated in IFT (Caris, Macharis, & Janssens, 2013). A dyad of a freight company and a terminal operator is suggested to use the same communication platform in order to be able to track and trace the shipments and at the same time expedite the right actions to unexpected incidents (Ibid). Such an agreement signifies players’ willingness to perform IT adaptation (López-Navarro, 2013).

A number of software models, which enable freight companies and terminal operators to support their activities, are available on the market (Marchet, Perotti, & Mangiaracina, 2012). Modern software platforms allow freight companies and terminal operators in IFT to track and trace the shipments, plan the route, schedule the cargoes, and automate freight payments (Marchet, Perotti, & Mangiaracina, 2012). Among transportation management applications, enterprise resource planning (ERP) system is widely used by freight companies and is argued to be one of the most efficient management models for the industry (Ibid; Seethamraju & Sundar, 2013; Buijs & Wortmann, 2014). ERP is applied in IFT to collect, store, manage and interpret data with the help of software systems such as SAP, IBM, Oracle, JDA, Sterling, etc. (Buijs & Wortmann, 2014).

Beside the IFT applications, the transportation chain actors require an information collection hardware tool, which allows to gain the necessary information on containers along the transportation chain (Ibid). One of the advanced devices available on the market is RFID, which allows to merge container information into one system (Harris, Wang, & Wang, 2015). This technology uses radio waves to identify items such as containers (Angeles, 2005). RFID tags consist of two parts, which are a microchip and an antenna (Ibid). Microchip can store object’s information, such as serial number (Lin & Ho, 2009). This information can be transferred to a computer with the help of an antenna (Ibid). RFID tags can be attached to the containers, which enable freight companies to track containers, as well as boxes and pallets included in the containers (Harris, Wang, & Wang, 2015). Moreover, with RFID tags freight companies and terminal operators are capable of monitoring the temperature and humidity of specific products (Andziulis et al., 2012). In addition, with global positioning system (GPS) devices, all the players in the transportation chain can track the containers in any part of the world (Harris, Wang, & Wang, 2015). This advanced tool works with satellite and provides
digital map database, path planning guidelines, and wireless communication (He et al., 2009). Companies invest in this tool in order to improve transportation process, reduce the manual work, and improve the real-time decision making (Habjan, Andriopoulos, & Gotsi, 2014). It is noticeable that GPS cannot communicate well with satellite in indoor locations to provide accurate location information (He et al., 2009). With GPS, dispatchers are able to disperse timely location information to their partners (Habjan, Andriopoulos, & Gotsi, 2014). This powerful tool can be attached to a power source, such as ocean vessel, truck or trains (Musa, Gunasekaran, & Yusuf, 2014). Finally, with standard applications and smart devices, container shipping becomes more standardized, which increases the customer satisfaction (Ibid).

4.2.4 Interaction between the information integration elements

The profit margin of participants in the transportation chain decreases due to extreme competition, shorter product life cycles, increasing fuel and labour prices as well as rising customer’s expectation (Verdonck et al., 2013). It is compulsory for the involved players to concentrate on cooperative relationship with other players along the chain (Ibid). One of the main aspects, which shape the level of cooperation, is the trust between companies operating in the transportation chain (López-Navarro, 2013). Lack of trust is considered a central issue in collaborative relationship where some companies are not willing to share certain information (Özener, Ergun, & Savelsbergh, 2011). Collaboration enables players to create an informal control system that smooths the process of information sharing and encourages partners to work interdependently in order to achieve synergy (Sandberg, 2005; Özener, Ergun, & Savelsbergh, 2011). Moreover, information sharing cannot be optimized to its full potential without technology support (Lumsden & Stefansson, 2007). By using advanced technology, information can be collected, processed, disseminated and used in real time, which increases the resource utilization and reduces the costs of operation along the transportation chain (Stefansson, 2002; Boschian, 2011). Additionally, it can be noted that a company’s effort to adapt the IT system of its partners signals its inter-organizational relationship commitment to the whole transportation chain (López-Navarro, 2013). From the partner’s side, that action is a sign of trustworthiness, which increases partner’s willingness to collaborate (Ibid). The synergy of these elements boosts the level of information integration between the partners, the way it is shown on Figure 7 below, and increases the performance efficiency of the whole
transportation chain (Özener, Ergun, & Savelbergh, 2011). The synergy’s benefit of these elements is evident, however, some organizations are designing their own systems without consideration of the synergy (Themistocleous, Irani & Love, 2004).

Figure 7. Information Integration in IFT Dyad

Source: composed by the authors.

4.3 Levels of Information Integration

Bagchi and Skjoett-Larsen (2003, p. 91) describe information integration within a SC as a tool that “permits management to examine the operations of the organization in a totality and not in a fragmented, functionally isolated manner”. According to authors (Ibid), information integration can be accomplished with help of information sharing, linking of technologies in use, resource pooling among SC partners, collaborative planning, forecasting and replenishment, learning from one another (Ibid). The findings from the research of Bagchi and Skjoett-Larsen (Ibid) suggest that information integration within a SC can be classified according to the provided scale, which includes low, medium and high level of information integration. A case is to be classified according to the choice of information integration tools (Ibid). As it can be seen in Table 3, outdated transaction and communication systems, limited use of hardware along the SC, and no collaborative planning, forecasting and replenishment (CPFR) and customer relationship management (CRM) are the signs of low information integration level. Mechanization of existing processes, intra-company transaction systems, use of software and hardware tools for communication and operations, experimental stage of CPFR are the signs of medium level of information integration. As for high level of information integration, the SC has to obtain an inter-company ERP, demonstrate extensive use of IT tools
for communication and logistics operations, build its value around the process improvement, perform CPFR and CRM fully.

Table 3. Levels of Information Integration in a SC

<table>
<thead>
<tr>
<th>Supply Chain Integration Using</th>
<th>Low Integration</th>
<th>Medium Integration</th>
<th>High Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transaction Systems</strong></td>
<td>• MRP II Systems • Legacy Systems</td>
<td>• ERP Systems (Intra-company, rigid interfaces) • Value: mechanization of existing processes</td>
<td>• ERP and SC Planning systems (Inter-company integration, flexible interfaces) • Value: process improvement</td>
</tr>
<tr>
<td><strong>Communication Systems, Internet/Extranet</strong></td>
<td>• Email/Fax/ Phone • Internet/ Extranet only used for limited purposes</td>
<td>• Few EDI (Electronic Data Interchange) • Internet links to the customer/supplier • Extranet</td>
<td>• Extensive use of EDI/Internet/XML links within supply chain</td>
</tr>
<tr>
<td><strong>Bar-coding and Track-and-trace Systems, Electronic POS (point-of-sale) Data Capture, Inventory Visibility</strong></td>
<td>• Only bar-coding of finished products • Track-and-trace and Electronic POS not used</td>
<td>• More extensive bar-coding, automated e-mail updates and configurations</td>
<td>• Bar-coding from entry to dispatch • Track-and-trace throughout the SC Key suppliers and customers connected</td>
</tr>
<tr>
<td><strong>Vendor Management Inventory (VMI), Collaborate Planning, Forecasting and Replenishment (CPFR), CRM</strong></td>
<td>• Not used</td>
<td>• Experimental stage with one or a few suppliers/customers</td>
<td>• Strategic suppliers have access to production plans, materials requirements, sales forecasts and orders • CPFR/VMI with key suppliers/customers • CRM with key customers</td>
</tr>
</tbody>
</table>

Source: Bagchi and Skjoett-Larsen, 2003, p.100

The three information integration elements in this research are adapted to the system of Bagchi and Skjoett-Larsen (2003), which is described above. This is done in order to enable the investigation of information integration between the freight companies and terminal operators. The features of the three elements are extracted from the theoretical findings of the previous sub-chapters. As it can be seen in the adopted table (Table 4), low level of information integration within IFT dyad stands for consideration stage of collaboration (no use of the available tools and internal stage of collaboration negotiation), minimum use of available tools.
for information sharing and no or outdated IT systems in use. Medium level is signified with the establishment stage of collaboration (some collaboration tools are used), use of some information sharing tools (Extranet links between partners, few EDI), IT tools are implemented but not adopted by both partners within dyad (software is not necessarily compatible, intra-company ERP with rigid interfaces). Dyad with high level of information integration operates at improvement stage of collaboration (total openness of plans, joint planning and forecasting, trust), and acquire extensive information sharing techniques (EDI/XML links, Extranet and/or Internet) along with use of up-to-date IT tools (RFID or GPS, joint e-hubs, inter-company ERP with flexible interface, compatible software). The authors note that a dyad can include features of various levels. In other words, investigation of information integration level and its elements within a given dyad can provide conclusions where, for example, two of the elements are at a medium level and the third element is at the high level. Such cases are classified according to the average level among the information integration elements with notes on additional or missing features.

Table 4. Levels of Information Integration in IFT

<table>
<thead>
<tr>
<th>Integration Tools</th>
<th>Low Integration</th>
<th>Medium Integration</th>
<th>High Integration</th>
</tr>
</thead>
</table>
| **Collaboration:** Joint planning, forecasting, trust | **Consideration stage:**  
- Collaboration tools are not used  
- Internal consideration of collaboration or negotiation stage | **Establishment stage:**  
- Collaboration development (not all tools are used) | **Improvement stage:**  
- Total openness to plans  
- Planning and forecasting with the partner  
- Trust |
| **Information Sharing:** Communication Systems, Internet/Extranet | - Email/Fax/Phone/Manual document exchange  
- Intranet | - Few EDI (Electronic Data Interchange)  
- Extranet links to the partner | - Extensive use of EDI/XML links within dyad  
- Internet/Extranet |
| **IT implementation and adaptation:** RFID (or its alternatives), Joint e-hub, Container visibility; Transaction System | - IT systems are non-compatible  
- Legacy System | - Some IT tools are implemented  
- ERP Systems (Intra-company, rigid interfaces) | - Use of RFID, GPS (or its alternatives)  
- Partners are connected through joint e-hub  
- ERP systems (inter-company integration, flexible interfaces)  
- Compatible/shared IT systems |

Source: composed by the authors (based on Bagchi and Skjoett-Larsen, 2003)
4.4 Summary of the theoretical study

Table 5 summarizes the theory finding regarding three elements of information integration in SCM and IFT, the interaction between information integration elements and the level of information integration. The theoretical summary is presented in responding to the research questions and the interview questions in Appendix A.

Table 5. Summary of the Theoretical Framework

<table>
<thead>
<tr>
<th>Theoretical Framework</th>
<th>Interview Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Collaboration</strong></td>
<td>2.1 - 2.5</td>
</tr>
<tr>
<td>• Collaboration concepts in SCM and IFT: Two aspects in collaboration: (1) The relationship between parties through goal congruence, forecasting, planning activities; (2) The processes when performing collaboration: Agree, Execute, Educate, and Share.</td>
<td></td>
</tr>
<tr>
<td>• Trust</td>
<td></td>
</tr>
<tr>
<td>• Recognition of collaboration benefits and barriers</td>
<td></td>
</tr>
<tr>
<td>• Collaboration consideration</td>
<td></td>
</tr>
<tr>
<td><strong>Information Sharing</strong></td>
<td>3.1 - 3.5</td>
</tr>
<tr>
<td>• The importance of information sharing in SCM and IFT</td>
<td></td>
</tr>
<tr>
<td>• Willingness of sharing information among players in SCM and IFT</td>
<td></td>
</tr>
<tr>
<td>• The process of information sharing along IFT: data collection, data processing, information dissemination and information use.</td>
<td></td>
</tr>
<tr>
<td><strong>IT implementation and adaptation</strong></td>
<td>4.1 and 4.2</td>
</tr>
<tr>
<td>• The importance of IT system in SCM and IFT</td>
<td></td>
</tr>
<tr>
<td>• IT implementation together with IT adaptation</td>
<td></td>
</tr>
<tr>
<td>• Benefits and obstacles when implementing IT system</td>
<td></td>
</tr>
<tr>
<td>• Introduction to a number of software using in IFT.</td>
<td></td>
</tr>
<tr>
<td><strong>Interaction between the information integration elements and Level of information integration</strong></td>
<td>5</td>
</tr>
</tbody>
</table>

Source: composed by the authors
Chapter 5. Empirical Study

In this chapter, the empirical data is collected with help of telephone and Skype interviews with freight companies and terminal operators, and is presented in form of dyad. In each dyad, general description of freight company and terminal operator is provided to the reader. It is followed by information regarding the three elements of information integration, which are collaboration, information sharing and IT implementation and adaptation. Evaluation of information integration is also investigated from interviewee’s perspectives. The dyads are assigned with names according to geographical location of the terminal operator of the given dyad.
5.1 Dyad 1 “Vietnam HCMC”

5.1.1 Freight company - Orient Overseas Container Line (OOCL)

5.1.1.1 General information

Orient Overseas Container Line (OOCL) is a Hong Kong global brand that offers integrated international container transportation, logistics services and terminal operation with more than 320 offices in 65 countries around the world (OOCL, 2015). It is fully owned by Orient Overseas International Limited group with total revenue in excess of US$6.5 billion (Ibid). OOCL is one of the world leaders in providing ocean shipping services, terminal operations, logistics services and supply chain management as well as advanced IT application (Ibid). OOCL’s fleet is considered as the youngest, largest, fuel efficient and environmentally friendly among other freight companies (Ibid). With the fleet of 240 vessels (combined capacity of 800,000 TEUs ranging from 2,992 TEU to 13,208 TEU), OOCL provides efficient operation and competitive service (Ibid).

In Vietnam, OOCL offers container shipping and logistics services such as transportation, warehouse and end-to-end supply chain management (OOCL Vietnam, 2015). The shipping service covers routes to and from North America, Europe, Australia and New Zealand, Intra-Asia, the Middle East and the Indian Subcontinent (Ibid). OOCL does not own any terminal in Vietnam, and thus, it uses terminal services provided by other organizations (Ibid).

When being asked about the respondent’s evaluation of information integration in the company, Ms. Ho (2015) states that advanced technology used in the company facilitates smooth flow of information sharing and tight collaboration with the terminal operator, which enables their integrated system to be optimized to its fullest. The company is quite satisfied with the three elements of information integration and their synergy (Ibid). She concludes that information integration is performed at high level (Ibid). Details of three elements of information integration are narrated in the following parts.

5.1.1.2 Collaboration

Collaboration is considered as a crucial element in the relationship between OOCL and TC-CL terminal operator (Ho, 2015). From the perspective of freight company, OOCL chooses to
cooperate with a terminal operator depending on its prestige, location, service rates and operating facilities (Ibid). For instance, a terminal that offers suitable price and is located closely to industrial areas, which saves the transportation cost for shippers, can be an ultimate choice for freight company (Ibid). Regarding the collaboration initiation, OOCL revealed that both parties, the company and TC-CL terminal operator, examined each other in order to reach the collaboration agreement (Ibid). However, if some freight companies or terminals are newly established and have not been widely known in the market (Ibid). Such a company has to be the initiator of collaboration in order to receive better support from terminal operators (in case of new freight companies) or to appeal to well-established freight companies (in case of new terminal operators) (Ibid). In the collaborative relationship, trust is perceived by OOCL through prestige (Ibid). To be more specific, as a large freight company, OOCL is trusted and supported by TC-CL terminal operator in terms of priority handling when its vessels depart or arrive (Ibid). At the same time, terminal operator obtains benefit/profit from OOCL when providing handling services for a large number of OOCL container throughput (Ibid). Therefore, OOCL’s prestige is considered to be an important aspect when gaining trust of a terminal operator (Ibid). From the interviewee’s point of view, this relationship within the dyad is so strong that terminal operator is perceived as a business unit of OOCL (Ibid).

5.1.1.3 Information sharing

With pre-and post-haulage, OOCL and customers are the two main participants involved in the container handling activities (Ho, 2015). After reaching an agreement on the price and shipping schedule, a booking is issued for shippers (Ibid). OOCL offers empty container, its seal and packing list form to shipper, which they can either pack their cargo into the container at the empty container storage or their own warehouse (Ibid). With post-haulage, OOCL announced the cargo arrival to consignee who brings the related documents to the company to receive the delivery order (Ibid).

Regarding long haulage route from terminal to terminal, OOCL updates the cargo and vessel location on its website for customers who would like to track and trace their containers (Ibid). Information about the practical voyage is also reported to destination terminal operators with the aim of supporting or preparing operational equipment for handling timely when the vessel arrives (Ibid).
When the container is transported to TC-CL terminal, cargo list is provided to terminal staff in order to enable the arrangement of the location and handling plan for containers (Ibid). OOCL informs the vessel’s estimated time of arrival to the terminal, beside the schedule of vessel departure and arrival that is sent to the terminal monthly (Ibid). Among these aforementioned activities, communicative methods that OOCL uses to interact with terminal operator is EDI (Ibid). When containers are stored at the terminal, an update of container location and condition is daily provided to OOCL for retrieval (Ibid). This activity is performed with support of the IT system used by terminal operator (Ibid). Other communication events between two players are carried out face to face or through conventional methods, such as email or phone calls (Ibid). OOCL is planning to use Apple Facetime technology for video conferencing over Wi-Fi networks with the terminal (Ibid) since this method is already utilized across OOCL centers in Hong Kong, Zhuhai, Shanghai, Manila, and San Jose (OOCL, 2015).

In order to communicate with other partners, OOCL uses EDI as a protocol for system-to-system integration (Ho, 2015). Since the software used by OOCL and the other partners are different, EDI provides standards for exchanging data electronically (Ibid). For receiving information, EDI converts the file into the format that is compatible with the company’s internal system (Ibid). Sending a document to partners, who also use EDI system, requires the transformation of the file into EDI format (Ibid). This conversion is automatically processed by EDI translator (Ibid). This standard communication protocol (EDI) improves operation of the company through the elimination of data double input, fewer errors and faster data circulation (Ibid). Moreover, this method saves cost as it minimizes phone and fax charge (Ibid). Standard EDI messages that OOCL uses are IFTSAI for sailing schedule, IFTMBF for booking request, IFTMBC for booking confirmation, IFTMBF for booking cancellation, IFTMIN for shipping instructions, IFTMCS for bill of lading information, IFTSTA for shipment milestone Status, and APERAK for message acknowledgement (OOCL, 2015).

5.1.1.4 IT implementation and adaptation

OOCL aims at becoming the industry leader on the dimension of IT application in container handling (OOCL, 2015). With the purpose of integrating all business processes into one system, OOCL launched Integrated Regional Information System “IRIS-2” in 1999 (Ibid). This software platform integrates OOCL data about routes, services and costs into a unique
According to the interviewee, the customers have access to this information (Ho, 2015). With the visibility along shipping route, delay or late submission of documentation is minimized (Ibid). Consequently, every party involved in the chain leverages operational efficiency (Ibid). Also, the software supports decision making and management system (Ibid).

In Vietnam, OOCL is the only freight company that deploys GPS for its vessels (Ho, 2015). GPS technology is introduced to the fleet since 2008, which is dedicated to collection of vessel’s berth actual time of arrival and actual time of departure (Ibid). However, as the GPS tracker products bought from the market are not durable and stable, the company built its own GPS trackers from the ground and attached them to the vessels in 2010 (Ibid). The system works as it is described in Figure 8. When being activated, GPS tracker updates its location and time, which are sent to GPS server through global system for mobile communication network (GSM) (Ibid). GPS server performs as a repository to store the information and recognize if vessels have arrived into or departed from the area of the berth (Ibid). Other application systems, such as scheduling application system, can access actual time of arrival/departure information from the GPS server (Ibid). According to OOCL, 14 ships with new attached GPS tracker show up to 80% improvement in signal reception (Ibid). OOCL believes that the average performance can be increased up to 98 to 99% when GPS is applied to all the vessels (Ibid).

Figure 8. GPS in OOCL

Source: composed by the authors
5.1.2 Terminal operator - Tan Cang - Cat Lai Terminal (TC-CL)

5.1.2.1 General information

Tan Cang - Cat Lai Terminal is located in Ho Chi Minh city and is owned by Saigon Newport Corporation, which was created in 1989 by the National Minister of Defense of the Socialist Republic of Vietnam (Tan Cang - Cat Lai Terminal, 2015). Besides terminal operations, Saigon Newport Corporation also provides other services such as logistics, education and training in marine and logistics, construction and mechanical services, real estate and technical services, IT solutions and application, IT equipment consulting and oil/petrol transport services, etc. (Ibid). Since the first container vessel handled at TC-CL terminal in 2002, the terminal has gone through many developing stages (Ibid). It is currently the biggest and most modern container terminal in Vietnam (Ibid). The terminal covers an area of 1,300,000 square meters (130 ha) with 7 berths (Ibid). The number of cranes and terminal tractors are respectively 20 and 200 (Ibid). It can accommodate vessels with maximum deadweight tonnage of 45,000 (2,900 TEUs) (Ibid). The terminal is designed to be able to handle 4.6 million TEUs a year (Ibid). Moreover, its warehouse networks extend over 24,000 square meters for export and 18,000 for import (Ibid). Due to its good location and affordable service provision, the terminal accounts for 85% of container imported and exported in the area market share (Ibid). Regarding container handling activities, TC-CL offers such services as cargo stevedoring and packaging, terminal/yard/warehouse services, port/transshipment port services, multimodal transportation, pilotage and tugboat services, container/vessel sanitation and repairing (Ibid). OOCL is one among many freight companies that choose TC-CL terminal for its container shipping operation (Ibid).

The terminal is currently the partner of many large freight companies (Dang, 2015). Standardized procedures and advanced technology application create competitive advantage for the terminal over other local and international terminals in the region (Ibid). Mr. Dang (2015) graded information integration in TC-CL terminal at high level. Collaboration, information sharing and IT implementation and adaptation are described as followings.
5.1.2.2 Collaboration

According to the interviewee, the collaboration between TC-CL and a freight company depends on the container throughput of that freight company at the terminal and the frequency of vessels that arrive or depart to/from the terminal (Dang, 2015). In case of OOCL, TC-CL terminal considers it as one of the large freight companies among APM-Maersk, Evergreen Line, Cosco (Ibid). These companies have long term agreements with the terminal for using the services and facilities provided by the terminal (Ibid). In most of the activities that involve two parties, the terminal collaborates with OOCL tightly in order to follow the schedule, reduce handling time and assure safety at the terminal (Ibid). The respondent also confirms that TC-CL terminal carries out joint planning with OOCL, which is based on one-year contract both companies have signed (Ibid). Both sides discuss the number of vessels that are handled during the year, which gates OOCL uses to arrive to or depart from (Ibid). Although the contract lasts one year, it is automatically renewed (Ibid). The price is the only part of the contract that is negotiated yearly and can change depending on the market situation and actual resource expense (Ibid). Regarding volume forecast, the terminal does not interact with OOCL, instead it utilizes macroeconomic instruments to predict (Ibid). In the past, before the relationship was established, both parties showed their interest in collaboration (Ibid). The priority terms and conditions were offered to OOCL by the terminal side (Ibid). At the same time, OOCL recognized strategic location and large operational scale of TC-CL terminal, as well as its good relationship with customs, shippers and forwarder/logistics providers (Ibid). Currently, the terminal reaches full handling capacity, thus in order to establish collaboration with other freight companies, TC-CL negotiates the possibility of using other terminals owned by the group when congestion happens at TC-CL terminal (Ibid).

5.1.2.3 Information sharing

Information sharing is described along the container handling process that takes place at the terminal as shown in Figure 9. When containers are transported to the storage freight station or stacking area from customer/logistic service providers, terminal employee at check-in area collects cargo list and issues bill/input card as being illustrated in step (1) (Dang, 2015). In step (2), the truck with container reaches the gate-in of the storage where terminal staff checks the container, truck, seal number and updates the container status in the input card, collects the
Information Integration in Intermodal Freight Transportation

card and inserts the information into the terminal software (Ibid). The truck driver is given a “BAT” card with a number that is used for communication between the driver and the employee who handles container lifting equipment (Ibid). When the truck arrives to container freight storage/stacking area in step (3), terminal staff checks the BAT and container number as well as stacks container in a planned position (Ibid). After that, the container can be moved to other places or from the storage to stacking area/berth to be ready for shipping, and therefore, the terminal is required to provide the container status for OOCL everyday (Ibid). The information is collected with the help of device called Hand-Held, which is attached to the container handling equipment (Ibid). Then the information is sent to OOCL through EDI interface. After transferring the container to the terminal, the truck leaves the terminal in step (4) and (5) (Ibid).

Figure 9. Container Handling on Arrival in TC-CL

Source: composed by the authors

Regarding vessel’s arrival, information exchange between two players is also collected through container handling process illustrated in Figure 10. When the terminal receives vessel notice of arrival, the terminal dispatcher arranges the berth for vessel entering (Ibid). Even though the contract states a specific berth for OOCL, the terminal arranges the berth depending on actual
situation (Ibid). This situation can be caused by circumstances when the other freight companies’ vessels or trucks depart/arrive too late or early and may occupy the berth assigned for OOCL (Ibid). After custom clearing in step (1) and (2), based on the transporting schedule, terminal employee unloads the container to the temporary area or storage waiting for receiver to pick it up in step (3) (Ibid). The activities from (4) to (7) that describe the pick-up of arrival container, is the same as the container transportation to the storage, which is described above (Ibid). The information about the container location is provided to OOCL by using the same technique (Ibid).

Figure 10. Container Handling on Departure in TC-CL

Source: composed by the authors

5.1.2.4 IT implementation and adaptation

TC-CL terminal uses TOPS application as its terminal management system provided by Realtime Business Solution (RBS) Company (Dang, 2015). The application consists of two major components, which are the foundation system TOPO and the graphical planning and equipment control system TOPX (Tan Cang-Cat Lai Terminal, 2015). This application reports real time container location, provides automatic planning for container storage and stacking area, allocates berth, crane and other container handling equipment (Dang, 2015). It optimizes
the terminal operation in terms of human resource reduction and lower time consuming (Ibid). Since the system is totally integrated, any activity performed by one user is visible to authorized users (Ibid). At the terminal, equipment and container status are updated through Hand-Held reader that is attached to handling equipment (Ibid). All the information is sent to the server wirelessly and embedded to the tracking system (Ibid). Even though the terminal has to inform OOCL about the container status at the terminal everyday, the freight company can check container status at the terminal website at any time (Ibid). On 20/2/2015, the terminal had launched the new container management software called TOPOVN, which has the function of controlling container database (Ibid). It collects the container information from the gate-in and is operated parallelly with TOPX (Ibid). The new software is in experimental stage, which is expected to reduce half of the time needed to handle a container from the gate-in to the storage and gate-out (Ibid). The respondent also states that the terminal is doing research and contacting ERP vendor in order to implement it in the near future. From the respondent perspective, GPS or RFID implementation at the terminal is plausible only when all the freight companies apply the technology (Ibid). Such a situation does not take place at the IFT market at the moment, and therefore, such devices are not planned to be used in the terminal (Ibid).

5.2 Dyad 2 “Vietnam BRVTP”

5.2.1 Freight company - Mitsui O.S.K Lines Vietnam Ltd.

5.2.1.1 General information

Mitsui O.S.K. Lines Vietnam, Ltd. (MOL) is an ocean shipping company that is partly owned by Mitsui O.S.K. Lines Group (Mitsui O.S.K Lines, 2015). The headquarter is located in Tokyo, Japan (Ibid). The group operates in various business areas (Ibid). With that said, the core business operation is related to the international shipping (Ibid). Currently, the group’s fleet is one of the largest in the world (Ibid). The fleet ranges from specialized dry bulkers, tankers that transport crude oil, to containerships that transport intermodal containers (Ibid). MOL offers container transport service with a wide network of ports, which is considered to be among the largest in the world (Ibid). The number of vessels that MOL operates is around 120, with the capacity ranging from 700 TEUs to 14,000 TEUs (Ibid).
In Vietnam, MOL offers not only container shipping but also logistics services that embrace all kinds of transportation modes (Ibid). The shipping service covers the routes to and from all continents (Ibid). MOL partly owns and operates one container terminal named Tan Cang Cai Mep International Terminal co Ltd (TCIT) in Vietnam (Ibid). MOL mainly uses this terminal for container handling when shipping from/to this area (Ibid).

According to the respondent evaluation, MOL’s container handling process is operated efficiently at TCIT terminal (Ibid). High level of information integration is the respondent’s comment (Ibid) when being asked about the evaluation of MOL’s information integration. Three elements of information integration in MOL are illustrated in the following parts.

5.2.1.2 Collaboration

MOL’s collaborative strategy with its terminal operator can be characterized as close partnership (Vo, 2015). In this relationship, MOL cooperates with TCIT in order to achieve operational efficiency, which in turn improves MOL’s performance and satisfies its customer (Ibid). Due to the strict confidentiality policy of the company, Mr. Vo (2015) could only reveal that each freight company has a distinct agreement with the terminal and the priority depends on the contribution of the freight company to the terminal (Ibid). Collaboration can allow certain container handling activities to be free of charge or to be provided with reducing price for the freight company (Ibid). A particular freight company can receive the priority of container’s movement into the storage or preceding loading/unloading container at the berth (Ibid). Mr. Dang (2015), who is the representative of TC-CL terminal in dyad one and used to work at TCIT, unveils that specific berths are allocated to MOL in order to assure that there is no chance of delay or congestion that affects MOL’s schedule. MOL carries out planning activities with TCIT, however, most of collaboration activities are dedicated to discussion about container handling activities, which assure the efficiency of operations (Vo, 2015) Regarding forecasting activity, MOL as a freight company provides their reports, planning and other market forecasts to TCIT, which is described later in the text section about the terminal operator (Ibid). Since both parties have the same holding company, they operate as two business units that contribute to the final success of the group. Tight collaboration is taken for granted (Ibid).
5.2.1.3 Information sharing

According to the interviewee, rules and procedures, which define the responsibility of shipper and freight company for receiving, transporting and delivering the cargo, follow Incoterm - a set of commercial terms issued by international chamber of commerce (Vo, 2015). Therefore, the process of container handling from shipper to the terminal and vice versa is similar among terminals within the region (Ibid). For example, with pre- and post-haulage, MOL and its customers (shippers) are the two main participants involved in the container handling activities (Ibid). The information provided to participating parties is described in dyad 1. Within this stage, TCIT acts as MOL’s container supervisor at the terminal, which allows shippers with appropriate documents to take empty containers (pre-haulage) or return containers (post-haulage) (Ibid). Regarding long haulage route from terminal to terminal, MOL uses vessel global positioning system to track the container’s location when it is on the sea (Ibid). Besides the information of vessel departure and arrival time, which is provided to the terminal monthly, TCIT can track the vessel on MOL’s website (Ibid).

Within the terminal, containers’ movement is standardized similarly to the one within TC-CL terminal that is described in dyad 1. The most important information that MOL provides to the terminal is the cargo list, which determines the container storage location, equipment usage and loading/unloading method (Vo, 2015). However, MOL does not need to inform TCIT about the vessel’s estimated time of arrival as the terminal is able to access real time MOL’s global positioning system of vessel (Ibid). In order to exchange information and business documents with TCIT, as well as other partners, MOL uses the globally accepted EDI standards (Ibid). However, the updated information about container status at TCIT is transferred directly to MOL’s operation system instead of using EDI (Ibid).

5.2.1.4 IT implementation and adaptation

Star-Net is the core system that MOL uses to control business cycle of the container and cargo transportation from origin to destination (Vo, 2015). This application is studied and created by MOL IT department (Ibid). It utilizes Oracle and the database, the user interface are hosted on the Unix server (Mitsui O.S.K Lines, 2015). The freight company access Star-Net using a Microsoft Windows based CITRIX (Ibid). The booking application, equipment and container management application, vessel space control application, equipment maintenance and repair
Information Integration in Intermodal Freight Transportation

application are operated based on this core system (Ibid). For instance, Global Equipment Management application allows the users to track the movement of MOL owned and leased equipment/containers within the terminal and container storage all over the world (Ibid). The database allows the users to purchase or lease equipment when necessary (Ibid). MOL’s EDI solution supports following message sets: ANSI-X12, UN/EDIFACT, XML (Ibid). Moreover, such communication methods as Digital Movers, Kleinschmidt, File Transfer Protocol and Simple mail transfer protocol are provided by MOL (Ibid). MOL has EDI data storage where MOL and its partners, including TCIT terminal, can access and track key data of container along the chain (Vo, 2015). Information gathered from various databases is utilized for controlling, analyzing, reporting, planning and forecasting activities (Ibid). For example, to produce a report or analysis within any business function, an application named Net Proceeds System uses the available information to generate reports that can be accessed by any business unit that belongs to the group (Ibid).

5.2.2 Terminal operator - Tan Cang Cai Mep International Terminal co Ltd (TCIT)

5.2.2.1 General information

TCIT is a container terminal located in Ba Ria-Vung Tau Province, invested and partly owned by MOL together with Saigon Newport Corporation (Vietnam), Hanjin Shipping (Korea) and Wanhai Shipping (Taiwan) (Tan Cang Cai Mep Terminal, 2015). It officially started its operations in January 2011 and is the only terminal in Vietnam that received investment from foreign freight companies (Ibid). The terminal provides high level of convenience for transshipment cargo to/from Ho Chi Minh City and other industrial areas that are located in the provinces of Dong Nai, Binh Duong and Long An (Ibid). There are three berths of 890 meters in length facilitated at the terminal, which can handle big sized vessel with deadweight up to 110,000 tonnages (10,000 TEUs) (Ibid). The terminal capacity is approximately 1.6 million TEUs and it is able to serve simultaneously 03 vessels (Ibid). Its container storage/stacking area covers 34 hectares, which serves 12 freight companies including MOL, Hanjin, Wanhai, Hyundai, APL, NYK, OOCL, etc. (Ibid). The terminal currently provides cargo handling service, ship chandler service, ship cleaning service, container transshipment service, repair and maintenance services for containers, trailers, trucks and handling equipment, reefer
insight service (Ibid). TCIT recent service includes routes to/from Europe, US West Coast, US East Coast, China, Japan and other ports within Vietnam (Ibid).

Mr. Vo (2015) remarked that TCIT is operated well with MOL, as he rarely experiences any problems with MOL’s container flow within the terminal (Ibid). All the information that TCIT gives to MOL is timely and precise (Ibid). The synergy of tight collaboration, good information sharing and efficient IT system enables TCIT to set a new record of 197.71 container movements per hour in Vietnam when operating MOL’s vessel in April, 2013 (Ibid). Mr. Vo (2015) stated that the terminal’s information integration in the relationship with MOL is at the high level. The following parts describe each element of information integration in TCIT.

5.2.2.2 Collaboration

Even though TCIT is partly owned and operated by MOL, the terminal sees MOL Vietnam freight company as its independent partner (Vo, 2015). In theory, the terminal is MOL’s vendor (Ibid). When being questioned about some priority policies that TCIT provides to MOL in container handling at the terminal, the interviewee replied that each freight company has specific consensus with the terminal. The priority depends on the contribution of freight company to the terminal in terms of the volume of container handling, revenue, etc. (Ibid). However, the priority is not too obvious or must not cause the delay problem in container handling for the other freight companies (Ibid). The partiality is considered by other freight companies when evaluating the potential collaboration with TCIT (Ibid). Beside the collaboration related to container handling that is described in dyad 1, TCIT has joint forecasting with MOL (Ibid). It is illustrated through the ability to access MOL’s market reports, analysis and forecasts (Ibid). With this information, TCIT approaches the container transportation market, shippers and logistics providers, which enable TCIT to be proactive in service providing (Ibid). For example, when the forecast predicts an increasing demand for container transportation in the region, the terminal may improve its capacity or increase handling equipment to guarantee swift and smooth operation (Ibid). As a recently built terminal, TCIT has to make effort to attract more freight companies to collaborate (Ibid). Every month, the terminal holds meetings with its current customers (freight companies) to receive evaluation and feedbacks, as well as it invites potential customers who may have an interest in
relationship with TCIT (Tan Cang Cai Mep Terminal, 2015). MOL, Hanjin and Wanhai are the three long term customers of TCIT that account for large number of container handling at the terminal (Vo, 2015).

5.2.2.3 Information sharing

The container movement within TCIT terminal occurs in the same way as that within TC-CL terminal, which is described in dyad 1. However, when the container is moved to other places or from storage to stacking area/berth to be ready for shipping, the way that the terminal updates the container status for MOL is different from other freight companies (Vo, 2015). In details, the information about MOL’s containers is updated directly into MOL’s system instead of using EDI interface that is applied for other freight companies (Ibid). In order to follow, track and trace container movement within the terminal, TCIT utilizes Hand-held device (Ibid). It is attached to container handling equipment and transfers the location of container and equipment wirelessly to terminal operation system in real time (Ibid). In the past, this process was implemented by workers who manually recorded container status and brought records to the office for manual input (Ibid).

When arriving, MOL’s vessels can dock at pre-assigned berth without terminal arrangement (Ibid). However, the terminal is required to schedule the unloading equipment and handler for MOL similarly to the other freight companies (Ibid). The same process is applied for trucks that arrive to pick up the container, as it is illustrated in dyad 1.

5.2.2.4 IT implementation and adaptation

TCIT terminal uses TOPX, which is considered as its terminal management system and provided by Real time Business Solution Company (Vo, 2015). This software enables the terminal to automatically plan the berth, container stacking area and storage, as well as allocate container handling equipment (Ibid). Moreover, it can provide real time container location report through Hand-held devices (Ibid). The operating principle of this device is that it reads the information on the container and updates positioning in real time, afterwards transfers the data to a server wirelessly (Ibid). From this server, any other operating software can get the information about the container at the terminal (Ibid). However, in the case of MOL who partly owns TCIT, the information about container status is updated directly to the freight company
management system (Ibid). The other freight companies that collaborate with TCIT, receive container status at the terminal daily through EDI interface (Ibid). When being questioned about ERP system, GPS and RFID, the interviewee responded that they are not implemented in the terminal since TCIT’s container throughput volume is not too large to fully optimize those techniques (Ibid). In the near future, when the terminal’s market share is improved to some extent, TCIT will apply ERP system (Ibid).

5.3 Dyad 3 “Iran”

5.3.1 Freight company - Borusan Company Ltd.

5.3.1.1 General information

Borusan Company was established in 1973, and, in the year 2000, has restructured its activities in order to provide services at the level of an integrated logistics provider (Borusan Lojistik, 2014). The headquarter of this company is located in Turkey (Ibid). With 4000 employees, Borusan spreads its business branches all around the world including countries of the Middle East, Europe, and USA (Ibid). In the field of transportation, this company provides international multimodal and container transportation, on road, rail, maritime and air modes (Ibid). The multimodal railway transportation is a new service of Borusan that enables customers’ freight to access any destination in Europe easily (Borusan Lojistik, 2014). As explained above, Borusan can provide international container transportation with the help of its highly experienced staff who organize loading/unloading services, cargo delivery to different customers, warehouse management service, and activities monitoring (Ibid). In addition, this company owns its vehicles that allow to carry containers all around the world (Ibid). With an international transportation route network, Borusan is able to organize the partial and full range container handling operations (Ibid). In order to keep and improve the competitive edge within the IFT industry, Borusan has established its own academy that includes two faculties, which are sales and leadership management (Rezaei, 2015). Continuous improvement stands as the key priority in Borusan’s business strategy, as it leads to persistently high performance results in relations with suppliers, shareholders, society, public administration and law, and employees (Borusan Lojistik, 2014).
According to Mr. Rezaei (2015), the three elements of information integration are well implemented and the level of information integration is considered at high level. This conclusion is made due to Borusan’s tight collaboration with terminal operator in Shahidrajaee port (Ibid). The following sub-chapters explain the three elements of information integration at Borusan Company.

5.3.1.2 Collaboration

According to Mr. Rezaei (2015), there is a high level of trust between Borusan and Tidewater Middle East. The interviewee also emphasizes that there are several reasons that stand behind solid collaboration, which lasts for more than a decade (Ibid). The joint planning activities take place on weekly bases (Ibid). The outcomes and decisions of these meetings are used by both players in organization of their container handling activities (Ibid). The terminal operator uses the information for organization of the container handling operations, which allows to optimize the equipment unitization and to carry out the container handling in a faster manner (Ibid). Furthermore, Borusan uses the same software for its container operations as the terminal operator in order to boost the collaboration effect, increase in efficiency and productivity of the operation (Ibid). Mr. Rezaei believes that a collaboration improvement can lead to gradual increase in revenues (Ibid). In addition, the terminal operator performs regular equipment maintenance operation in order to meet or exceed Borusan’s standards (Ibid). According to the interviewee (2015), Tidewater Middle East is the head terminal operator in the Shahid Rajaee port that offers a wide range of marine and port services including shipping, dredging, transit, civil projects and technology. Borusan is satisfied with the services of this terminal operator, and thus, no discussion and planning for further collaboration take place (Ibid).

5.3.1.3 Information sharing

In the beginning of the container handling process, Borusan Company sends an inquiry to the customers, which is based on different container sizes and prices in order to get an approval (Rezaei, 2015). After getting an approval from the customers, the information must be written in the standard form such as consignee information, cargo details (commodity, weight packing type, etc.), required container type and the number of containers, loading/discharging place, and terms of delivery (Ibid). Before containers arrival in the terminal, certain information must be sent to the terminal operator through EDI system (Ibid). This information includes type of
cargo, type of packaging, consignee details and the special handling instruction for hazardous and liquid cargos (Ibid). The freight company gets notification and reference number through EDI system when the terminal operator receives the containers (Ibid). At this stage, the terminal operator’s responsibility is to update container status and the departure time of the vessels to the freight company (Ibid). The company believes that by sharing information, storage costs can be reduced or even eliminated, and thus, there is a win-win situation for both the company and the terminal operator (Ibid). According to the freight company, EDI is a key component of just-in-time operations, which enables the company to manage and control the information flow in an efficient way (Ibid). Herewith, the paperwork is eliminated, which results in remarkable savings in administrative and personnel costs (Ibid).

5.3.1.4 IT implementation and adaptation

Borusan Company uses different IT systems according to different operations it performs (Rezaei, 2015). The software called Container Information Management system is used in order to track the containers (Ibid). This system’s data is visible to both the company and its terminal operator, which enables the company to see the container status and operations performed by terminal operators (Ibid). Furthermore, loading and unloading planning can be organized through this system, as the information is accessible by both parties (Ibid). With this system, a notification for inspection procedures can be sent to customers via SMS (Ibid). Apart from this software, EDI is used to send and receive the documents as well as execute the custom operations, which are connected to the custom authority system (Ibid). Another software called SAP is used to support all functions from sales and procurement to finance and human resources (Borusan Lojistik, 2014). In addition, the software called Blade, which is a kind of ERP system, is implemented in order to support land transportation operations for all Burusan’s offices, including the one located in the port (Ibid). According to the interviewee (2015), RFID is not implemented to track and trace the containers since this tool is very expensive. Furthermore, the freight company would need to install RFID chips on each container, which is not economically feasible (Ibid). The GPS is implemented on the vessels to provide time and location information (Ibid). When vessels arrive, the company can get notification about the containers by terminal operators through EDI interface (Ibid). However,
it is noted that GPS is implemented for monitoring of vessels and vehicles, but not individual containers (Ibid).

5.3.2 Terminal operator - Tidewater Middle East (TME)

5.3.2.1 General information

Ports and Maritime Organization is the port and maritime authority of the Islamic Republic of Iran that plays the role of administrator in all Iranian ports (Shahidrajaeeport, 2015). One of these ports, which are studied in this research, is Shahid Rajaee Port (Ibid). The port plays the key role in Iran's economy and trade, as most of the export and import flows pass through it (Ibid). The total area of the port covers 25 km² in which 7.5 km² is dedicated to supportive activities (Ibid). The two container terminals of this port provide services for more than 21 freight companies (Ibid). The length of the first terminal berths is 958 meters with a capacity of 1500000 TEUs per year (Ibid). The second terminal has a capacity of 1800000 TEUs per year and the total area of this terminal is 67 hectares (Ibid). Tidewater Middle East is the main terminal operator at Shahid rajaee port with more than 36 years of experiences in marine service sector (Tidewater, 2010). The terminal operator offers four different services in this port, which are handling of containers, general and miscellaneous cargo, bulk cargos, and fluids and tanks (Ibid). As TME carries out more than 90% of container handling, freight companies including Borusan are highly interested in collaboration with TME (Ibid).

The three elements of information integration are evaluated by Mr. Kiani (2015) at a high satisfactory level. The following section will present the three elements of information integration in TME.

5.3.2.2 Collaboration

According to Mr. Kiani (2015), there is a strong collaboration between TME and Borusan freight company. The collaboration includes exchange of information regarding the daily activities and the information that accelerates operations (Ibid). According to the interviewee, both parties are perceived as initiators of collaboration (Ibid). Furthermore, TME provides superior services for freight companies with up-to-date software and suitable equipment such as terminal tractors, top lift trucks and especial cranes (Tidewater, 2010). Mr. Kiani states that the collaboration between TME and the freight company is developed to a degree when no plan
for the future collaboration development is being discussed. Regarding interorganizational partnerships, shared experience and trust are considered as crucial accordingly to TME, as the terminal and its collaborative freight companies can create a mutually beneficial performance condition (Ibid).

5.3.2.3 Information sharing

At the first stage, which is called “Deliver to Shipper”, freight company forwards notification via EDI to terminal operators in order to pick up empty containers (Ibid). Freight companies send their containers to clients for goods loading (Kiani, 2015). Afterwards, shippers load the containers and return the full containers to the terminal along with a bill of lading (Ibid). For this operation, freight company sends bill of lading to the terminal operator via EDI (Ibid). The bill contains information regarding consignee, number of shipping units, description of articles, weight, kind of packaging, and rates (Ibid). Freight companies do not have to pay for the first 10 days of their containers in the terminal (Ibid). After the 10 days period, freight companies are charged for extra storing days according to the tariffs that are provided in the contract (Ibid). Based on the schedule given by freight companies, the terminal operator moves containers to the container yard for loading into a vessel (Ibid). After vessel’s departure/arrival, the terminal operator provides a list of actual loaded/unloaded containers to the freight companies through EDI or sometimes via fax (Ibid). Mr. Kiani also explains that container position in the yard can be seen through the software database, which reflects all the container transportation that takes place inside terminal and is connected to the freight companies’ system (Ibid).

5.3.2.4 IT implementation and adaptation

According to Mr. Kiani (2015), since the United States and the member states of the European Union have imposed the unprecedented sanctions on Iran companies, TME cannot take advantage of latest technologies. However, Iranian IT experts provided a solution to TME by designing and implementing the first container comprehensive software in this industry, which enables the container transportation visibility (Ibid). This software is called Tidewater Container Terminal System and used by TME in all container handling operations (Ibid). With the help of this software, the terminal operator is able to track the container location and status in the container yard, allocate resources, monitor the real time operation, and protocol the
invoice cross check (Ibid). The interviewee also states that another IT system called Container Information Management system is used in this port and by TME in particular (Ibid). The same system is used by Borusan Company (Ibid). Mr. Kiani stated that TME does not consider implementation of RFID in their terminal operations due to the high price of this IT tool. However, GPS is already installed on the terminal vehicles in order to track and trace the container transportation inside the terminal and report it to TME clients (freight companies) (Ibid).

5.4 Dyad 4 “Russia”

5.4.1 Freight company - Arkas Russia Ltd.

5.4.1.1 General information

Arkas Holding was established in Turkey in 1944 (Arkas, 2015). Nowadays, operating in 20 countries, it provides a wide range of logistics services, as it merges terminal operators, airline services, shipping companies of all modes and other services with specialization on Middle East, North Africa, Western and Eastern Europe and Russia (Ibid). One of Arkas Holding business units is Arkas Russia Ltd., which emerges on the market as a freight company that operates in Russian Federation (Arkas Russia, 2015). Arkas Russia specializes in intermodal freight transportation “door-to-door” in southern regions of Russia and builds a competitive advantage by freight transportation monitoring and custom guiding (Ibid). Company’s transportation hub is attached to Novorossiysk Sea Port, which is the intermodal terminal for the given freight company (Ibid). The largest share of Arkas Russia’s freight units is standard ISO containers (TEU and FEU), while the company also offers transportation of FEU high cube, 45-foot containers, foldable TEU and foldable FEU, refrigerator containers and ISO cisterns (Ibid). Among various services and transportation modes, Arkas Russia offers maritime, road and railway transportation of freights in standardized containers and freights of various sizes and level of attention required (temperatures, levels of risks involved etc.) (Ibid). The company also provides services of container transshipment and stocking, freight guidance in Novorossiysk customs and internal customs transit in Russia (Ibid). Arkas Russia outsources certain orders, which happens more often in cases of railroad and road transportation modes (Ibid; Yakubovskaya, 2015).
Aarkas Russia implements all three elements of information integration to a certain extent, as it became apparent in interview with Ms. Yakubovskaya (2015). According to presented scale, information integration level of Aarkas Russia is evaluated at a satisfactory high level in the conclusion of interview. The three element of information integration within Aarkas Russia are presented further.

5.4.1.2 Collaboration

According to Ms. Yakubovskaya (2015), Aarkas Russia Ltd. distinguishes two forms of collaboration when working with container terminals. The first more efficient type is the collaboration with terminal operators that belong to Aarkas Holding (Ibid). According to the interviewee (Ibid), business units within the holding are created with the goal of achieving smooth flowing performance that allows to increase the quality of interunit interaction and the organization’s performance in general. For such a case, Aarkas Russia Ltd. has an experience and certain protocols to follow when collaborating with a terminal (Ibid). Major part of terminal operations is carried out in collaboration with units of Aarkas Holding, which automatically increases the collaboration quality (Ibid). Thus, when collaborating with another business unit, processes such as joint planning and communication are a standard procedure that does not cause complications and high time consumption (Ibid). At the stage of collaboration establishment, these processes are commonly guided by the holding collaboration supervisor (Ibid). On the other hand, it can be noted that each case of collaboration with a terminal operator from the holding is unique and commonly takes a different form from one another (Ibid).

The other collaboration type in Aarkas Russia Ltd. is the collaboration with terminal operators outside Aarkas Holding, such as Novorossiysk Commercial Sea Port (Ibid). According to the interviewee (Ibid), diversity of markets, operations and performance algorithms differ significantly among terminal operators, which lead to additional complications when establishing collaboration. Aarkas Russia Ltd. plays the role of initiator in all the cases of collaboration, which leads to higher investments in time, labor and, consequently, finances (Ibid). This kind of initiatives requires careful research, evaluation and consideration before moving on with the initiative (Ibid). This type of collaboration is more complex and requires sophisticated planning and evaluation, as these partnerships are commonly built to last (Ibid).
That is why an establishment stage of collaboration usually requires more resource than the stage of execution (Ibid). Herewith, one can see how trust is a bigger challenge to accomplish than it is in case of collaboration with a terminal operator from Arkas Holding (Ibid). Collaboration with an “insider” is less complicated and more efficient than with an “outsider” (Ibid). That is why, in times of market expansion, Arkas Holding creates new terminals or acquires a local terminal, which enables efficient cooperation with the new business unit of the holding (Ibid). However, this practice does not take place often enough to reconsider collaboration practices with an “outsiders” (Ibid). Herewith, the future of collaboration with the holding “insiders” and “outsider” is not likely to face qualitative changes (Ibid).

5.4.1.3 Information Sharing

Efficient information sharing is one of the key requirements for the high quality services provided by Arkas Russia Ltd (Ibid). The company collects information during the transportation of containers and shares it with customers and partners, such as Novorossiysk Port (Ibid). Information regarding vessel schedule and container location, temperature and seal status is collected and available for the customers and partners (Ibid). However, container tracking does not usually represent an object of interest for terminal operators (Ibid). Information on containers and vessels is collected (GPS) and shared (EDI) automatically with customers and terminal operators within all the transportation stages (PPH, terminal transportation, long haulage) (Ibid). Terminal operators receive information regarding the vessel (identification), its arrival (time and location), type, size, ID and filling status of freight units (Ibid). This process is performed with the help of EDI system and usually does not face complications (Ibid). Information exchange is carried out with terminal operators on a regular basis, which means that freight is transported through established routes and that the list of container terminals does not vary significantly through time (Ibid). In this way, Arkas Russia Ltd. is always aware of the terminal schedule and has access to necessary information from the terminal operator database (Ibid). When transporting containers inside the terminal, operator is required to provide information on the cargo transportation status and location (Ibid). This is a necessary requirement of Arkas Russia Ltd., as the company releases this information to its customers as a part of its services (Ibid). This information is received automatically with the help of electronic updates in a form of automatic reports in the end of each terminal
transit stage (Ibid). Arkas Russia uses this information when optimizing the freight transportation on customs and when organizing the loading and departure of vehicles for further transportation (Ibid). Communication method with terminal operators is carried out with the help of phone calls and EDI (EDIFACT standards), which meet the expectations and requirements of Arkas Russia (Ibid). The interviewee (Ibid) notes that adding XML documents to information exchange method is being considered by Arkas Russia, as the practice of simultaneous use of EDI and XML attracts attention of the freight company.

5.4.1.4 IT Implementation and adaptation

The logistics operations of the company are organized with the help of “1C:TMS Логистика. Управление перевозками” (“1C:TMS Logistics. Transportation management”), which is based on platform “1C:Предприятие 8.2” (“1C:Venture 8.2”) (Ibid). The product is a result of 1C and AXELOT cooperation (Ibid). This ERP of the new 1C generation was developed by the software provider with attention to feedbacks and wishes of Arkas Russia (Ibid). The company has been loyal to 1C ERP systems for over ten years and it pays back (Ibid). The system is a convenient choice for logistics operations of Arkas Russia and nowadays has not yet faced serious competition on the market, according to the interviewee (Ibid). 1C:TMS is used for creation of transportation routes, protocols and documentation, monitoring of the container status and location, notifications of partners’ tariffs fluctuations, creation of operational and accounting reports (Ibid). Finally, 1C:TMS assures efficiency and resource optimization for Arkas Russia operations on all transportation modes (Ibid). The benefit of the system is the maximal automation of freight transportation processes and collection of data about them (Ibid). Thus, the dispatchers carry only the responsibility of data monitoring and operations management, and the risk of human error is reduced to a minimum (Ibid). The information about containers and their status is open for their forwarders (clients of Arkas Russia) and is automatically reported to terminals (Ibid). The system also allows to reduce time and number of interactions with potential clients, as it optimizes the process of order applications filling (Ibid).

Akaras Russia uses customized GPS/GLONASS tracers that allow to collect information about the freight transportation status, which is further processed and reported to customers and partners such as Novorossiysk Port (Ibid). The tracers are attached to vehicles, but not to
containers, as this scenario would have been too expensive for the kind of operations Arkas Russia performs (Ibid). The existing method allows to have the necessary information and high quality of the service in order to remain highly competitive position of Arkas Russia on international market (Ibid). The commonly known disadvantages of GPS in the industry are significantly reduced with the help of the tracers’ customization, which was provided by the hardware producer (Ibid).

5.4.2 Terminal Operator - Novorossiysk Commercial Sea Port (NCSP)

5.4.2.1 General information

Novorossiysk Commercial Sea Port Group includes eight open joint-stock and private limited companies (Novorossiysk Commercial Sea Port (NCSP), NovorosLesExport, Ship Yard Novorossiysk, IPP, Novorossiysk Grain Terminal, Fleet NCSP, Baltic Stevedore Company and Primorsk Oil Terminal) with specialization in maritime terminal services, freight storing and transportation, and operates on southern regions of Russian Federation (NCSP, 2015). Open joint-stock company NCSP specializes in stevedore services provided in Novorossiysk Sea Port (Ibid). The port plays a role of one of the key hubs in Russia’s network of freight transportation routes and operates as a head venture of the NCSP Group, which was responsible for 21% of total freight turnover in 2014 in Russia (Ibid). NCSP connects routes for Russian exporting and importing from countries of the Mediterranean, the Middle East, North Africa, Southeast Asia, North and South America (Ibid). The port is located in the eastern part of Black Sea (the location and map are provided in Appendix B) and benefits the company and its customers by its geographical location (port is located at the crossing point of multiple transportation routes and is positively affected by the weather conditions that allow it to function 12 months a year, unlike northern port in Russia) (Ibid). The NCSP terminal works with freight of various types (liquid bulk, dry bulk, general and containers) and is connected to inland transportation routes with road and railroad (Ibid). The terminal’s physical characteristics include area of 95,6 ha, 510 000 m of port waters, 44 berths, 9,4 km of berth length, up to 24 m of berth depth, 70 million tones (1st in Russia, 3rd in Europe) of freight turnover in 2013, over 7000 workers, and revenues of 14,4 billion RUB in 2014 (Ibid).

NCSP provides services to multiple logistic companies from Russia and many other countries (Ibid; Lyshtvan, 2015). Arkas Russia is one of the key customers of NCSP (Ibid). The
information integration is evaluated by Ms. Lyshtvan (2015) as decently high. The manager also noted that improvement of information integration processes is possible and expected during the terminal expansion in the future (Ibid). This information is provided in the following sections.

5.4.2.2 Collaboration

Collaboration takes place between NCSP and freight companies, as both sides require collaboration for transportation optimization, which leads to increase of performance efficiency of each side involved (Ibid). The company accents attention on horizontal collaboration and invests in tight relations with other terminals and their operators (Ibid). However, the importance of tight reliable cooperation with freight companies like Arkas Russia is recognized by NCSP (Ibid). The terminal operator organizes quarterly meetings with representatives of the cooperating freight companies in order to discuss collective performance, the future perspectives of collaboration and ongoing contracts (Ibid). Consistency in high quality services and the review of collaboration play an important role in the process of trust establishment (Ibid). Trust and loyalty of freight companies like Arkas Russia are valued by NCSP in challenging times that NCSP goes through (Ibid). Significant losses of the company, due to recent currency rate fluctuations and emergence of the new international class port “Bronka” in St. Petersburg, made the operator reevaluate the long-term strategy and its relations with freight companies (Ibid). In order to strengthen its positions on the market and motivate collaboration, NCSP invests in creating a new terminal that will increase its capacity nearly to a double (Ibid). The company also reconsiders conditions of contracts with the freight companies in a way that will allow to strengthen collaboration with existing customers and potentially attract new ones (Ibid). In this scenario, NCSP can obtain the role of collaboration initiator in order to support stability of the revenue growth, unlike it is done in usual circumstances (Ibid).

5.4.2.3 Information Sharing

Container transportation and storing (if ordered) inside the terminal is organized in a way that allows to optimize the container handling (Ibid). NCSP receives the information regarding the type and amount of containers from the freight companies in advance in order to prepare suitable equipment and storage area (Ibid). Normally this data is stated in pre-signed contract,
which means that big part of the necessary information is available to the terminal operator in advance (Ibid). In practice, port dispatchers constantly monitor vehicles that are expected to deliver and pick containers from the terminal, adjust operations according to notifications of expected deviations (if any) from the freight companies, receive and share updates on weather conditions, collaborate with customs that operate parallel with the terminal operator (Ibid). During the container transportation inside the terminal, the operator collects information regarding the freight transportation status for further sharing (Ibid). Other information is withheld due to security reasons (Ibid). The process of information exchange with freight companies is to result into smooth flow of the terminal operations (Ibid).

Information sharing is performed with help of EDI and XML (Ibid). EDI, as a mature method of information exchange, cannot be completely replaced by XML in NCSP (Ibid). That is why both exchange methods are used in daily operation (Ibid). NCSP is in a “must have” situation regarding communication methods due to its position in international transportation chains (Ibid). In other words, the port with the leading position in Russia and the third position in Europe by the volume of the container turnover is an organization that has to keep up-to-date with all the high-end communication methods (Ibid). That is why NCSP has chosen to obtain advantages of the two communication methods - EDI that allows to carry out high volume of information and XML that appears as a very flexible language comfortable for intraorganizational information exchange (Ibid).

5.4.2.4 IT implementation and adaptation

Recently NCSP went through a total software update and now successfully works with software “1С:Управление предприятием 2.0” (“1С:ERP Venture management 2.0”) based on “1С:Предприятие 8.3” (“1С:Venture 8.3”) (Ibid). Before the introduction of the new system, the company was operating on few various software that served different purposes (Ibid). 1С:ERP unites management over activities of the company, such as resource planning and management, accounting, calculation of the services costs, monitoring and management of terminal operations (Ibid). The software was adapted to specifics of NCSP terminal operations by the software provider, that also provided training for NCSP users (Ibid). The obvious advantage of the software is its multi level applicability that allows employees from different departments to operate within the same system (Ibid). It means that economists, dispatchers
and logistics supervisors receive and protocol data in a single unified information space (Ibid). Consequently, no time is spent for transfer of data between the terminal divisions (Ibid). The system also allows to insert data in a much faster way in comparison to previously used software (Ibid). The ERP enables implementation of flexible terminal transportation tariffs for the customers, which is highly demanded at the challenging financial time that NCSP goes through, as every client is more important than ever (Ibid). Nowadays, processes of resource planning, taxing, intraorganizational document circulation, information collection and report generation, contracts accounting, procurement and supplier relationship management, freight transportation and storing, and other logistics operations are automated to a highest degree, which brings terminal performance to high quality that is worth of NCSP position (Ibid). The processes of container information collection and their quality are at the highly satisfactory level, according to the interviewee (Ibid), which explains why NCSP does not apply any of the hardware equipment pieces when working with containers in their terminal.
Chapter 6. Analysis

This chapter provides analysis of the data collected within theoretical and empirical studies in previous chapters. At first, the readers are presented with within case analysis, which includes analysis of each dyad individually. This analysis allows to draw conclusions regarding the level of information integration and its elements within each studied dyad. It also allows to compare conclusions of the information integration level in dyads from the perspective of the interviewed players and the results collected during the theoretical framework application. The result of within case analysis is utilized further for cross case analysis. Herewith, comparison of dyads is carried out on dimension of individual elements of information integration. Similarity and differences of the features and levels of elements of information integration among dyads enable the authors to make conclusions about the general level of collaboration, information sharing and IT implementation and adaptation in IFT industry. This analysis allows to extract information for the response to the research question.
6.1 Within Case Analysis

6.1.1 Dyad 1 “Vietnam HCMC”

6.1.1.1 Collaboration

According to researchers (Kuo & Miller-Hooks, 2012; López-Navarro, 2013; Goerlandt & Montewka, 2015), low recognition of collaboration benefits is a common issue among freight companies and terminal operators. However, empirical information from the interview with Ms. Ho (2015) shows that the freight company recognizes the importance of collaboration within the dyad. Even though the interviewee (Ho, 2015) did not mention joint planning, the description of information visibility along the container handling process reveals that OOCL has joint planning with the terminal operator. This conclusion is supported by the definition, which describes joint planning as the process of identifying, clarifying and establishing the information exchange to support the collaboration (Hadaya & Casivi, 2007). From the interviewee’s perspective (Ho, 2015), the freight company’s trust in the partner depends on the partner’s prestige. The authors believe that the terminal is trusted by the freight company. According to the authors, collaboration between two players has gone through consideration stage since they already coordinate container operations jointly. Nevertheless, the collaboration is not at improvement stage yet, as forecasting activity is still implemented at internal level from both sides. Information from TC-CL terminal operator shows that the level of collaboration with the freight company is based on benefits that the terminal gains through the container throughput. The terminal has joint planning with the freight company as being indicated by Mr. Dang (2015), whereas forecasting activity of the terminal is implemented internally.

From the aforementioned analysis, one can come to a conclusion that the level of collaboration within the dyad is at the medium level. This conclusion is drawn from following facts: both players are at the establishment stage of collaboration, where joint planning is implemented, trust is achieved to some extent, but forecasting activity is not carried out. These features are illustrated in Table 6.
6.1.1.2 Information Sharing

The freight company manually circulates pre- and post- haulage related information, such as packing list and delivery order among players. However, with long haulage route the freight company uses EDI to communicate with other players including the terminal operator. Empirical data reveals that OOCL allows the containers to be tracked and traced with the help of the company’s website, which means that part of information network is accessible to “outsiders”. This notion indicates that the Extranet is applied in the company, but it is used for limited purposes. Email, phone calls and Apple FaceTime technology are also mentioned as communication methods used by the freight company. From the interview with TC-CL terminal operator, the authors disclosed that interaction between truck driver and terminal employee (check-in and container handling) is carried out in a form of manual documentation exchange. Similarly to the freight company, the terminal utilizes EDI for sharing container status information with the partner. Additionally, the freight company can check container status at the terminal website, which determines that the terminal applies Extranet to certain extent.

From the analysis of information sharing between the two players, it is obvious that EDI is not used extensively within the dyad since certain information exchange activities, which occur along the container handling process, optimize this communication method. From above analysis, one can infer that the level of information sharing within this dyad is at medium level as being described in Table 6.

6.1.1.3 IT implementation and adaptation

The interview shows that the freight company is using GPS for updating vessel’s berth actual time of arrival and departure. It is noticeable that the GPS tool is only used to recognize and collect the information when vessels have arrived into or departed from the area of the berth instead of updating the information for the whole voyage. Therefore, one can conclude that the company’s GPS tool is implemented but not optimized to its fullest potential. It is mentioned in the interview that all the information is integrated into a unique database of IRIS-2 software, which provides information for employees and partners involved. In the authors’ opinions, this platform can be seen as a part (module) of company’s ERP system since it provides an integrated view of data for both partners and employees. However, the database is mostly
utilized for the internal usage, as only information of container and vessel status is available for “outsiders”. Hence, this module of ERP system is considered as intracompany system. Regarding the terminal’s IT system, Hand-Held reader is the device used for collecting real time data of handling equipment and container status. Moreover, the device provides automatic planning for other container handling activities. With the terminal, it seems that IT tool is optimized to its fullest potential, according to the authors. However, according to the interviewee (Dang, 2015), one can recognize that IT tools are not applied within all the activities along the container handling operations. For example, manual collection of information occurs from gate-in to storages.

Analysis of IT implementation and adaptation within the dyad allows to conclude that both players have exploited IT tools, such as GPS and Hand-Help software, in their operations. However, it can be noted that the players utilize IT tools to a different degree. From the empirical data, it is noticeable that even though the freight company applies ERP system, the terminal operator receives benefits from it. In conclusion, the level of IT implementation and adaptation is considered as medium in this dyad, as being indicated in Table 6.

6.1.1.4 Level of Information Integration within the Dyad

From the analysis of three elements of information integration within the dyad, the authors reach the conclusion that the information integration between OOCL freight company and TC-CL terminal operator is at the medium level. The conclusion is extracted from the medium levels of collaboration, information sharing and IT implementation and adaptation within the dyad. However, this outcome is different from the interviewees’ perceptions of the level of information integration. Specifically, both Ms. Ho (2015) and Mr. Dang (2015) evaluated information integration in their companies at high level. Hereby, one can also conclude that there is a differentiation between employee’s perception and analysis results of the level of information integration within the dyad. The summary of analysis and conclusion of level of information integration are illustrated in the Table 6 as following.
Table 6. Information Integration in Dyad 1 "Vietnam HCMC"

<table>
<thead>
<tr>
<th>Information Integration Elements</th>
<th>Freight Company OOCL</th>
<th>Terminal Operator TC-CL</th>
<th>Dyad 1 “Vietnam HCMC”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Collaboration Establishment Stage</td>
<td>• Joint planning • Trust</td>
<td>• Joint planning • Trust</td>
<td><strong>Medium Level:</strong> Establishment Stage • Joint planning • Trust</td>
</tr>
<tr>
<td>2. Information Sharing</td>
<td>• EDI • Email, phone calls • Extranet used for limited purposes</td>
<td>• EDI (partly implemented) • Manual document exchange • Extranet used for limited purposes</td>
<td><strong>Medium Level:</strong> • EDI (partly implemented) • Email/Phone/Manual document exchange • Extranet used for limited purposes</td>
</tr>
<tr>
<td>3. IT implementation and adaptation</td>
<td>• GPS • ERP Systems (Intracompany)</td>
<td>• Hand-Help (GPS alternative)</td>
<td><strong>Medium Level:</strong> • GPS, Hand-Help • ERP Systems (Intracompany)</td>
</tr>
<tr>
<td>Level of Information Integration</td>
<td>• High Level (Ho, 2015)</td>
<td>• High Level (Dang, 2015)</td>
<td><strong>Medium Level</strong></td>
</tr>
</tbody>
</table>

Source: composed by the authors

6.1.2 Dyad 2 “Vietnam BRVTP”

6.1.2.1 Collaboration

Since both players within the dyad are owned by the same holding company, they are considered as business units, according to Mr. Vo (2015). From the information collected, it becomes apparent that the freight company receives distinct priorities from the terminal operator, which are specific berth usage, discounts and services free of charge in some container handling activities. The authors believe that those priorities are impossible to achieve for other freight companies since both players within this dyad are working towards the same goal. That means that the advantages that one player can create for the other one contribute to the holding company. It signifies tight collaboration within the dyad. Joint planning between the two players is mentioned by Mr.Vo (2015), referring to container handling operations.
Beside the inevitable collaboration, the freight company has joint forecasting with the terminal operator, in which one can access reports, analysis and forecasts of the other. Hereby, high level of trust is recognized in this dyad as both players open their plans and join forecasts. From the given information and theoretical framework, it is noted that the collaboration within this dyad is in improvement stage and is considered as high level, which can be seen in Table 7.

6.1.2.2 Information Sharing

The interview with Mr. Vo (2015) indicates that both the freight company and the terminal operator apply EDI in order to exchange information and business documents along the container handling process. Other conventional methods of communication, such as phone calls, email and fax, are not mentioned during the interview, which implies an extensive use of EDI for information sharing activities within the dyad. According to researchers (Dürr & Giannopoulos, 2003; Hanssen, Mathisen, & Jørgensen, 2012), the way information is organized and shared along the chain determines the cost efficiency of transportation. In case of this dyad, updated information status at the terminal is transferred directly to MOL’s operation system, which optimizes time and resource, and, consequently, optimizes costs in operation. It also means that the terminal can access internal operation system of freight company, which unveils that both players use the same system to receive and update information of container along the transportation chain (known as Extranet). Therefore, the authors can conclude that the level of information sharing between the freight company and the terminal operator is performed at high level as being indicated in Table 7.

6.1.2.3 IT implementation and adaptation

Even though Mr. Vo (2015) did not mention of ERP system, the authors consider that Star-Net software partly performs the functions of ERP system. Most of the container handling operations and management applications are based on this system. One of the applications collects information from multiple databases to generate reports, which can be accessed by any company that belongs to the group. This application is considered as a joint e-hub, according to the authors. As the internal information of the freight company is available to the terminal operator, the ERP system is perceived as an intercompany system. Regarding the terminal operator, an ERP system has not been implemented. However, the terminal is operating well
together with the freight company as it benefits from the partner’s ERP system. While IT tools of the freight company are not described by Mr. Vo (2015), Hand-Help is mentioned as a device used by the terminal operator for automatic updating of a container status. This information is transferred to other freight companies by EDI method. However, in case of MOL it is updated directly to the freight company’s management system. Therefore, a conclusion of sharing IT system used for controlling container information within the dyad can be stated from the given information.

From the above analysis, sharing IT system and joint e-hub are noted in this dyad. Even though ERP system is implemented only by one player, both players achieve benefits from the system. All in all, as being shown in Table 7, one can conclude that high level of IT implementation and adaptation is achieved in this dyad.

6.1.2.4 Level of Information Integration within the Dyad

As being illustrated in Table 7, collaboration, information sharing and IT implementation and adaptation are performed at high level. Therefore, one can come to a conclusion that high level of information integration appears in this dyad. It is remarkable that both players in the dyad are owned by one holding company and, thus, tight collaboration is recognized and supported by employees from both sides. Sharing IT system within the dyad also supports good information exchange along the container handling process. In this dyad, one can identify the synergy among the elements of information integration. Conclusion of high level of information integration within the dyad was supported by the interviewee’s (Vo, 2015) opinion.

Table 7. Information Integration in Dyad 2 "Vietnam BRVTP"

<table>
<thead>
<tr>
<th>Information Integration Elements</th>
<th>Freight Company MOL</th>
<th>Terminal Operator TCIT</th>
<th>Dyad 2 “Vietnam BRVTP”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Collaboration</td>
<td>Improvement stage</td>
<td>Improvement stage</td>
<td>High Level: Improvement stage</td>
</tr>
<tr>
<td></td>
<td>• Joint planning and forecasting</td>
<td>• Joint planning and forecasting</td>
<td>• Total openness to plans</td>
</tr>
<tr>
<td></td>
<td>• Trust</td>
<td>• Trust</td>
<td>• Joint planning and forecasting</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Trust</td>
</tr>
</tbody>
</table>

87
Information Integration in Intermodal Freight Transportation

2. Information Sharing
- Extensive use of EDI
- Extranet

High Level:
- Extensive use of EDI
- Extranet

3. IT implementation and adaptation
- ERP (Intercompany)
- Joint e-hub
- Sharing IT system

High Level:
- Hand-Help (GPS alternative)
- Sharing IT system

Level of Information Integration
- High level (Vo, 2015)

High Level

Source: composed by the authors

6.1.3 Dyad 3 “Iran”

6.1.3.1 Collaboration

Collaboration is considered as significant element, which contributes to gradual increase in revenue, according to Mr. Rezaei (2015). Thus, this element should be contemplated by terminal operator and freight company. According to Hadaya and Casivi (2007), joint planning can increase the visibility of information exchange between the partners and make the collaboration more effective. The empirical findings show that Burosan Company takes advantage of joint planning with its partner in order to increase the visibility of information exchange. According to the interviewees (Kiani, 2015; Rezaei 2015), the same software, which is called Container Information Management system, is used by both partners in order to support collaboration and enhance the information exchange. Thus, this feature can strengthen trust between partners. From the interviewee’s perspective (Rezaei, 2015), there is a high level of trust between the freight company and terminal operator. From the terminal operator’s perspective, trust is beneficial for partners in a competitive market. In this regard, trust is considered as a key component that enables operation acceleration and market success for both the freight company and the terminal operator.

From the above analysis, the authors conclude that the level of collaboration is at medium level as not all collaboration tools are used, as it is summarized in Table 8. Since the freight
company and terminal operator are satisfied with the level of collaboration, there is no future plan for collaboration development.

6.1.3.2 Information Sharing

According to the interviewee (Rezaei, 2015), some significant information, such as cargo data (commodity, weight packing type, etc.), is sent to the terminal operator through EDI system. In this context, EDI is not used extensively by the freight company. Additionally, the terminal operator receives bill of lading in advance through EDI system. In this regard, the terminal operator is not fully exploiting EDI system for data transaction. According to the interviewee (Kiani, 2015), the same software is used to track the container position in the yard and share this information between partners, which proves that both players use the Extranet. Hence, the freight company can take advantage of this software to monitor the container position in the yard in order to update its clients. Moreover, in some occasions the terminal operator sends the actual loaded/unloaded containers’ information via fax to the freight company. It is noted by the authors that fax is not as modernized as EDI system with standard formats.

From the given explanations, the level of information sharing in this dyad is at medium level. As being shown in Table 8, EDI is used only for limited purposes and fax is mentioned as another information exchange method.

6.1.3.3 IT implementation and adaptation

The freight company takes advantages of different IT tools. The main software, which allows both partner to communicate with each other, is Container Information Management system. With the help of the system, information is exchanged more rapidly with less errors between the players. According to the empirical data, the freight company has implemented SAP, which provides ERP functions in an efficient manner that allows a cross-functional team to share information and knowledge. GPS is installed on vessels and vehicles by the terminal operator and the freight company. RFID, as an alternative, is not implemented by the players due to the high cost of operation and installation. The empirical data reveals that the terminal operator implemented the software that is developed by Iranian experts (Tidewater Container Terminal System), which is not connected to the freight company but is completely compatible with the partner's software.
From the analysis, one can conclude that the level of IT implementation and adaptation is at medium level. As being shown in Table 8, compatible software system is used by both partners, which allows to communicate and share essential information in efficient manner. Apart from the compatible systems, each player has its own IT system in order to communicate with different departments. GPS is deployed by both the freight company and terminal operator.

### 6.1.3.4 Level of Information Integration within the Dyad

According to the analysis above, the three elements of information integration are rated at medium level in this dyad, as it can be seen in Table 8. By means on the analysis and theoretical framework, the authors conclude that the information integration within dyad 3 “Iran” is performed at medium level. One noticeable feature in this dyad is that the interviewees’ perceptions are different from the analyzed outcome, referring to the level of information integration. Therefore, one can conclude that there is a misperception of the level of information integration within this dyad.

Table 8. Information Integration in Dyad 3 "Iran"

<table>
<thead>
<tr>
<th>Information Integration Elements</th>
<th>Freight Company Borusan Company</th>
<th>Terminal Operator TME</th>
<th>Dyad 3 “Iran”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Collaboration</td>
<td><em>Establishment stage</em></td>
<td><em>Establishment stage</em></td>
<td><em>Medium Level:</em> Establishment stage</td>
</tr>
<tr>
<td></td>
<td>• Joint planning</td>
<td>• Joint planning</td>
<td>• Joint planning</td>
</tr>
<tr>
<td></td>
<td>• Trust</td>
<td>• Trust</td>
<td>• Trust</td>
</tr>
<tr>
<td>2. Information Sharing</td>
<td>• EDI</td>
<td>• EDI</td>
<td><em>Medium Level:</em> EDI</td>
</tr>
<tr>
<td></td>
<td>• Fax</td>
<td>• Fax</td>
<td>• Fax</td>
</tr>
<tr>
<td>3. IT implementation and adaptation</td>
<td>• Compatible IT system</td>
<td>• Compatible IT system</td>
<td><em>Medium Level:</em> Compatible IT system</td>
</tr>
<tr>
<td></td>
<td>• GPS</td>
<td>• GPS</td>
<td>• GPS</td>
</tr>
<tr>
<td></td>
<td>• ERP (Intracompany)</td>
<td></td>
<td>• ERP (Intracompany)</td>
</tr>
<tr>
<td>Level of Information Integration</td>
<td><em>High Level (Rezaei, 2015)</em></td>
<td><em>High Level (Kiani, 2015)</em></td>
<td><em>Medium Level</em></td>
</tr>
</tbody>
</table>

Source: composed by the authors
6.1.4 Dyad 4 “Russia”

6.1.4.1 Collaboration

The freight company appears to be at the establishment stage of collaboration with the investigated terminal operator. This conclusion can be drawn from the fact that the planning and forecasting are not carried out continuously with the terminal operators outside Arkas Holding. However, the freight company recognizes the importance of collaboration, dedicates resources to its establishment and betakes the role of collaboration initiator. This fact points at a collaboration development process. Furthermore the freight company features trust as a component of collaboration, which is a sign of a high integration level. In its turn, the terminal operator within the dyad organizes meetings with cooperating freight companies, which could be a sigh of high collaboration. However, it appears that the quarterly meetings that are dedicated to joint planning and forecasting are not carried out with the studied freight company. The terminal operator does not seem to provide total openness of plans to the freight company in this dyad. It can be noted that the terminal operator perceives trust as an important collaboration element.

It can be concluded that the collaboration within the dyad is at the stage of establishment, as not all available collaboration tools are used. Furthermore, the players demonstrate no openness to plans. Yet, both interviewees (Lyshtvan, 2015; Yakubovskaya, 2015) stated the presence of trust between the players. Thus, the researchers evaluate the dyad’s collaboration at a medium level with trust featuring, as it is shown in Table 9.

6.1.4.2 Information Sharing

The freight company performs information sharing and communication with the help of various tools. The information is collected and shared with the terminal operator by means of phone calls and EDI system, which allows to link information flow to the terminal operator. Use of telephone for sharing of information regarding container transportation signifies low level of information sharing. With that said, use of few EDI indicates information sharing of medium level. The terminal operator, in its turn, carries out information sharing with the freight company with the help of XML and EDI, which link information flow between the players of the dyad. Herewith, the terminal operator demonstrates the capacity of bringing the
information sharing element to a high level with the help of extensive use of EDI and XML. However, the terminal operator does not join the information sharing system with the freight company and, thus, use of Extranet is not developed to a high degree.

The information sharing within the dyad appears to be at a medium level, as it is shown in Table 9. Both players share information regarding container handling by means of EDI and Extranet links within the dyad. These methods signify medium level of information sharing. Moreover, one of the players uses telephone calls as a method of information sharing, which is a sign of low information sharing level, according to the theoretical framework.

6.1.4.3 IT implementation and adaptation

GPS/GLONASS system, which is applied by the freight company, allows to benefit both players within the dyad. The freight company’s operations are organized with help of 1C:TMS system. The software represents a modern ERP system with flexible interface and multiple benefits that are extensively used by the freight company. Thus, the IT tools of the organization point at a high level of IT implementation and adaptation. At the same time, the terminal operator uses the software system 1C:ERP, which is based on the same platform from 1C as the system that is used by the freight company. That allows to conclude that players’ IT implementation and adaptation are at a high level of integration due to compatible IT and use of ERP with flexible interface.

For the given information integration element, the authors conclude high level of IT implementation and adaptation, as it is shown in Table 9. The dyad features compatible IT systems and ERPs with flexible interfaces. Furthermore, GPS/GLONASS system, which is installed by one of the dyad players, benefits both dyad players at a high level.

6.1.4.4 Level of Information Integration within the Dyad

As it can be seen in sub-chapters above and in Table 9, the analysis provides various results regarding the levels of the information integration elements within the given dyad. Collaboration and information sharing are rated at a medium level, while IT implementation and adaptation element shows high level. It can be concluded that at the moment dyad 4 “Russia” operates at a medium level of information integration, even though the collaboration and information sharing within the dyad show certain features of high level.
It also can be noted that the conclusions of the within case analysis for dyad 4 “Russia” differ from the conclusion provided by the interviewees. Thus, both representatives of the dyad players stated high level of information integration within the dyad (Lyshtvan, 2015; Yakubovskaya, 2015). However, the analysis, in accordance with the theoretical framework, points at a medium level of information integration and allows to assume the existence of the information integration level misperception within the dyad.

Table 9. Information Integration in Dyad 4 "Russia"

<table>
<thead>
<tr>
<th>Information Integration Elements</th>
<th>Freight Company Arkas Russia</th>
<th>Terminal Operator NCSP</th>
<th>Dyad 4 “Russia”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Collaboration</strong></td>
<td>Establishment stage</td>
<td>Establishment stage</td>
<td>Medium Level Establishment stage</td>
</tr>
<tr>
<td></td>
<td>• Collaboration development</td>
<td>• Collaboration</td>
<td>• Collaboration development</td>
</tr>
<tr>
<td></td>
<td>• Trust</td>
<td>• Joint planning and</td>
<td>• Trust</td>
</tr>
<tr>
<td></td>
<td></td>
<td>forecasting with some</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>partners</td>
<td></td>
</tr>
<tr>
<td><strong>2. Information Sharing</strong></td>
<td>Phone calls</td>
<td>EDI</td>
<td>Medium Level</td>
</tr>
<tr>
<td></td>
<td>• EDI</td>
<td>• Extranet links</td>
<td>• Phone calls</td>
</tr>
<tr>
<td></td>
<td>• Extranet links</td>
<td>• XML</td>
<td>• EDI</td>
</tr>
<tr>
<td><strong>3. IT implementation and adaptation</strong></td>
<td>GPS/GLONASS</td>
<td>Compatible IT</td>
<td>High Level</td>
</tr>
<tr>
<td></td>
<td>• Compatible IT</td>
<td>• ERP with flexible</td>
<td>• GPS/GLONASS</td>
</tr>
<tr>
<td></td>
<td>• ERP with flexible interface</td>
<td>interface</td>
<td>• Compatible IT</td>
</tr>
<tr>
<td><strong>Level of Information Integration</strong></td>
<td>High Level (Yakubovskaya, 2015)</td>
<td>High Level (Lyshtvan, 2015)</td>
<td>Medium Level</td>
</tr>
</tbody>
</table>

Source: composed by the authors

6.2 Cross Case Analysis

6.2.1 Collaboration in IFT

As being shown in Table 10, trust is a common feature of collaboration in all the dyads. This signifies that trust is taken into consideration as a strategically significant element to develop a
long-term relationship between the terminal operators and freight companies. Unlike dyad 4 “Russian”, three other dyads have implemented joint planning as the key component of efficient collaboration in order to increase the information visibility and optimize the container handling process. As can be seen in the Table 10, dyad 1 “Vietnam HCMC”, dyad 3 “Iran” and dyad 4 “Russian” are in collaboration development stage, which is concluded from the fact that not all tools have been used to reach the improvement stage of collaboration. Only dyad 2 “Vietnam BRVTP”, which is classified into improvement stage of collaboration, has shown forecasting as one of the critical features of collaboration. According to the authors, this influential feature is the backbone of an effective container handling process that allows to determine future demands patterns between the freight companies and terminal operators. It is apparent that collaboration, as one of information integration elements, has been recognized by all the dyads but at different levels. The conclusion of medium level of collaboration for dyad 1 “Vietnam HCMC”, Dyad 2 “Iran” and dyad 4 “Russia” in within case analysis comes from the implementation of some significant features, such as trust, joint planning, and collaboration development. Features of total openness to plans, joint planning and forecasting, and trust are found in dyad 2 “Vietnam BRVTP”, which determines high level of collaboration.

From the above analysis, it is obvious that the majority of studied dyads shows medium level of collaboration, except one outstanding dyad with high level. The empirical data attributes this exception to the situation where both players are owned by the same holding company. Therefore, the authors can conclude that the level of collaboration between the freight companies and the terminal operators is at medium level. Since the research sample represents the population of medium and big terminal operators in the industry, the authors conclude that the level of collaboration between freight company and terminal operator is at medium in cases that belong to the described population.

6.2.2 Information Sharing in IFT

In order to investigate the level of information sharing, which is later used for exploring the level of information integration between freight company and terminal operator, comparison of features of information sharing among dyads is conducted. It is noticeable that EDI is utilized in all studied dyads, which satisfies the medium level of information sharing according to the theoretical framework. However, one may recognize the difference in the degree of EDI
utilization among dyads. Hereby, the extensive use of EDI is identified in dyad 2 “BRVTP Vietnam”, while dyad 1 “Vietnam HCMC” demonstrates partly implemented EDI along with email and phone calls for information sharing. The remarkable feature of manual document exchange, which occurs in dyad 1 “Vietnam HCMC”, supports the conclusion of partly implemented EDI. It signifies the medium level of information sharing in this dyad. In dyad 3 “Iran” and dyad 4 “Russia”, EDI is described as a communication method that is used simultaneously with phone call and fax, which signify the medium level of information sharing. Within case analysis shows that Extranet is utilized in all dyads except one - dyad 3 “Iran”. Apart from the full optimization of Extranet in dyad 2 “Vietnam BRVTP”, the other two dyads do not deploy it at high degree. Similarly to EDI feature, the degree of Extranet usage among dyads is different. Analysis of the features of information sharing in dyad 1 “Vietnam HCMC”, dyad 3 “Iran” and dyad 4 “Russia” provides results of medium information sharing level, whereas dyad 2 “Vietnam BRVTP” is classified as high information sharing level. In case of this dyad, the two players are owned by one holding company, which can be the reason behind the extensive use of EDI and Extranet. Hence, the case of dyad 2 “Vietnam BRVTP” is considered as an exception in the industry, where plausible conditions for information sharing are achieved by companies that behave like business units. From the analysis, the majority of the dyads shows medium level of information sharing, which allows the authors to come to the conclusion that the level of information sharing between freight company and terminal operator is at medium level. Since the research sample represents the population of medium and big terminal operators in the industry, one can infer that the level of information sharing between freight company and terminal operator regarding the defined population within the IFT industry is performed at medium level, which is later illustrated in Table 10.

6.2.3 IT implementation and adaptation in IFT

Within case analysis provides results with features of different levels of IT implementation and adaptation among the studied dyads. Thus, as it is summed up in Table 10, in dyad 1 “Vietnam HCMC” and dyad 3 “Iran” within case analysis shows medium level of IT implementation and adaptation, while dyad 2 “Vietnam BRVTP” and dyad 4 “Russia” the level is high.
It can be noted that, among the studied cases, no dyads feature characteristics of low level of IT implementation and adaptation. IT tool like GPS or its alternatives are used for collection of information during the container handling processes within all four dyads. According to the chosen theoretical framework, use of such tool signifies high level of IT implementation and adaptation. Herewith, it appears that the GPS, as an information collection tool, is applied on vehicles and vessels of the studied companies, but not on containers. In some cases, only one player uses GPS or its alternative, which allows both players to benefit from the IT tool. It can also be noted that the companies within the research sample do not use RFID. Furthermore, three of the dyads appear to operate compatible container handling software, which allows to optimize information sharing and signifies high level of IT implementation and adaptation within the industry. In case of dyad 2 “Vietnam BRVTP”, the two players carry out operations and information integration as business units and, thus, apply joined software system for container handling. Moreover, dyad 2 “Vietnam BRVTP” is the only dyad within the research that utilizes joint e-hub. Thus, joint e-hub does not appear as a common feature in IT implementation and adaptation within the defined research population in IFT. All four dyads feature ERP systems in their IT implementation and adaptation. However, according to the within case analyses, three out of four dyads do not bring their ERP systems to the intercompany level. Herewith, according to the within analysis, in dyads 1 “Vietnam HCMC” and 3 “Iran” only freight companies implement ERP systems, which benefit both players within the given dyads. Thus, ERP systems within IFT appear to be implemented at intracompany level, which signifies medium level of IT implementation and adaptation.

As it becomes apparent in within and cross case analysis that IT implementation and adaptation element of information integration does not include features that allow to draw definite conclusion regarding the level of this element within IFT industry. Cross case analysis of the IT implementation and adaptation features, across the studied dyads, does not allow to confidently conclude whether the level of the element is medium or high. In other words, dyads combine features of medium and high levels of the investigated information integration element. Likewise, the results are not conclusive in analysis of the element’s level in within case analysis – two dyads were concluded to operate at the medium level and two other dyads appeared at high IT implementation and adaptation level. As it is shown in Table 10, the authors provide a conclusion of medium/high level of IT implementation and adaptation within
the IFT (for dyads with port terminals of medium and big size). This level refers to a situation in the research and, conclusively, in defined sector of IFT industry, where all dyads have reached medium level of IT implementation and adaptation. Furthermore, the conclusion regarding the level also includes the fact that the implementation of certain IT tools across that studied dyads signifies high level features. Hence, shift towards the high level of IT implementation and adaptation with the IFT industry appears to be a likely scenario.

6.2.4 Information Integration in IFT

The level of information integration within IFT is defined by means of the levels of the three information integration elements - collaboration, information sharing, and IT implementation and adaptation. The cross case analysis, provided in previous sub-chapters, allows to conclude that the collaboration among the studied dyads is at the medium level, as it is shown in Table 10. From this analysis outcome, the authors draw this conclusion regarding the collaboration level within the defined population in the IFT industry. Likewise, the authors make conclusions regarding the information sharing, which appears to be at a medium level, as it is summed up in Table 10. Furthermore, cross case analysis showed mixed results regarding the IT implementation and adaptation within the defined population in IFT. In regard of this element, the authors provide a conclusion of medium/high level, which stands for complete medium level with inclusion of certain high level features. Thus, the analytical result regarding the information integration within the defined population in the IFT industry provides medium level of information integration, as it is shown in right lower corner of Table 10.

This conclusion is supported by the outcomes of the within case analysis. The information integration among the studied dyads is at the medium level on average. In detail, the within case analysis provides results of medium information integration level in dyads 1 “Vietnam HCMC”, 3 “Iran” and 4 “Russia”. Analysis of dyad 2 “Vietnam BRVTP” shows high level of information integration. Herewith, the authors note that performance of dyad 2 “Vietnam BRVTP” is organized in a manner of two business units, which could be a reason of an outstanding information integration level.
<table>
<thead>
<tr>
<th>Information Integration</th>
<th>Dyad 1 “Vietnam HCMC”</th>
<th>Dyad 2 “Vietnam BRVTP”</th>
<th>Dyad 3 “Iran”</th>
<th>Dyad 4 “Russia”</th>
<th>IFT</th>
</tr>
</thead>
</table>
| 1. Collaboration       | **Medium Level:** Establishment Stage  
  - Joint planning  
  - Trust | **High Level:** Improvement stage  
  - Total openness to plans  
  - Joint planning and forecasting  
  - Trust | **Medium Level:** Establishment stage  
  - Joint planning  
  - Trust | **Medium Level:** Establishment stage  
  - Collaboration development  
  - Trust | **Medium Level** |
| 2. Information Sharing | **Medium Level:**  
  - EDI (partly implemented)  
  - Email/Phone/Manual document exchange  
  - Extranet used for limited purposes | **High Level:**  
  - Extensive use of EDI  
  - Extranet | **Medium Level:**  
  - EDI  
  - Fax | **Medium Level:**  
  - Phone calls  
  - EDI  
  - Extranet links | **Medium Level** |
| 3. IT implementation and adaptation | **Medium Level:**  
  - GPS, Hand-Help  
  - ERP Systems (Intracompany) | **High Level:**  
  - Hand-Help  
  - Joint e-hub  
  - ERP (Intercompany)  
  - Share IT system | **Medium Level:**  
  - Compatible IT system  
  - GPS  
  - ERP (Intracompany) | **High Level:**  
  - GPS/GLONASS  
  - Compatible IT  
  - ERP (Intracompany; flexible interface) | **Medium/High Level** |

Source: composed by the authors
The within case analysis provides the research with finding regarding the perception of the information integration level in accordance with responses of the companies’ representatives - participants of the research. The summary of perceptions and their comparison with the results of within case analysis is presented in Table 11. As it can be seen in the table, all the interviewees have come up with high level of information integration within their dyads. At this point, it can be noted that the interviewees were questioned about the level of information integration in their dyads in accordance with the provided information integration features from the theoretical framework. As a result, dyad 1 “Vietnam HCMC”, dyad 3 “Iran” and dyad 4 “Russia” demonstrate a mismatch in the within case analysis outcome and the managers’ perception of information integration level within these dyads. In dyad 2 “Vietnam BRVTP”, the manager’s perception of the dyad’s information integration level matched the conclusion made in within case analysis.

Table 11. Perception of Information Integration Level within IFT

<table>
<thead>
<tr>
<th>Information Integration</th>
<th>Dyad 1 “Vietnam HCMC”</th>
<th>Dyad 2 “Vietnam BRVTP”</th>
<th>Dyad 3 “Iran”</th>
<th>Dyad 4 “Russia”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers’ Response</td>
<td>• High Level (Ho, 2015) • High Level (Dang, 2015)</td>
<td>• High level (Vo, 2015) • High Level (Rezaei, 2015) • High Level (Kiani, 2015)</td>
<td>• High Level (Yakubovskaya, 2015) • High Level (Lyshtvan, 2015)</td>
<td></td>
</tr>
<tr>
<td>Research Conclusion</td>
<td>• Medium Level</td>
<td>• High Level</td>
<td>• Medium Level</td>
<td>• Medium Level</td>
</tr>
<tr>
<td>Comparison</td>
<td>Mismatch</td>
<td>Match</td>
<td>Mismatch</td>
<td>Mismatch</td>
</tr>
</tbody>
</table>

Source: composed by the authors

Herewith, the research sample demonstrates tendency of the information integration level misperception within the defined population of IFT. That means that the players within the studied dyads do not perform information integration at a high level, according to the theoretical framework, despite their evaluation. This misperception can potentially signify concerns regarding effectiveness and understanding of information integration among freight companies and terminal operators in IFT. Such a scenario can lead to an outcome where companies do not recognize information integration improvement opportunities.
Chapter 7. Conclusion

In this chapter, the research findings are presented. The conclusion regarding the level of information integration between freight company and terminal operator within the defined population of IFT industry is drawn from the analytical chapter. The identification of information integration level, which is concluded from the level of three elements of collaboration, information sharing and IT implementation and adaptation, contributes to the existing theory and practice of the field. Limitations of the research are also indicated together with generalization of the results, own reflection - criticism and the description of potential topics for future research.
7.1 Answering the Research Question

With the help of the findings from the analytical chapter, the authors are enabled to respond to the research question:

“What is the level of information integration between a freight company and a terminal operator in IFT?”

Medium level of information integration within the dyad in IFT (referring to the defined population) is concluded as the result of this research. This level of information integration is determined by the means of the levels of collaboration, information sharing and IT implementation and adaptation. Specifically, cross case analysis suggests medium level for each element of information integration. It can be noted that the IT implementation and adaptation element was defined at medium level and included certain features of high level. This outcome is also supported by within case analysis that shows medium level of information integration in studied dyads. Dyad 2 “Vietnam BRVTP” appears as an exception in within case analysis as the two players are considered as business units within a holding company. The findings of this thesis are summarized by the following Table 12, which describes the level of information integration in dyads with medium and big terminals within IFT industry.

Table 12. Summary of the Research Findings

<table>
<thead>
<tr>
<th>Information integration</th>
<th>Dyad 1 “Vietnam HCMC”</th>
<th>Dyad 2 “Vietnam BRVTP”</th>
<th>Dyad 3 “Iran”</th>
<th>Dyad 4 “Russia”</th>
<th>Information integration in IFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Collaboration</td>
<td>Medium Level</td>
<td>High Level</td>
<td>Medium Level</td>
<td>Medium Level</td>
<td>Medium Level</td>
</tr>
<tr>
<td>2. Information Sharing</td>
<td>Medium Level</td>
<td>High Level</td>
<td>Medium Level</td>
<td>Medium Level</td>
<td>Medium Level</td>
</tr>
<tr>
<td>3. IT implementation and adaptation</td>
<td>Medium Level</td>
<td>High Level</td>
<td>Medium Level</td>
<td>High Level</td>
<td>Medium/High Level</td>
</tr>
</tbody>
</table>

Level of information integration | Medium | High | Medium | Medium | Medium |

Source: composed by the authors
Furthermore, the research findings point at the information integration level misperception among the managers within the studied dyads and, potentially, in the whole research population. Responses of the interviewees mismatch the results of the analysis regarding the information integration level in six out of seven cases (six out of seven interviewees). According to the analysis findings, managers within the investigated freight companies and terminals tend to evaluate their dyad’s information integration at the level that is higher than it’s meaning in accordance with the theoretical framework of this research. This conclusion is drawn from the fact that six interviewees evaluated their dyads’ information integration at a high level, while in theoretical analysis these dyads received medium level, as it can be seen in Table 11. Only in one dyad (“Vietnam BRVTP”) researchers’ and manager’s evaluation matched.

### 7.2 Generalization of Results

The findings of the research carry specific conclusions regarding levels of information integration and its elements, which are determined at the medium level on average. Eight studied companies in four dyads are sampled with predetermined criteria of dominant freight unit used in operations (containers), modality (intermodal transportation) and size of the terminal with a dyad (medium and big). The snowball sampling method and stated criteria provided a variety of companies with location in different geographical regions and different information integration features (collaboration tools, container handling software, etc.). However, the authors highlight the fact that despite certain differences among dyads, one can note an overall consistency among conclusions of within and cross case analysis. This notion supports the reliability of findings and their representativeness of the total research population. In other words, geographical variety among sampled dyads and relative consistency of information integration levels among studied cases enable a conclusion of sample’s fair representation of the research population and practical applicability of the extracted knowledge.
7.3 Research Contribution

7.3.1 Theoretical Contribution

Theoretical investigation shows that there is no exact knowledge regarding the level of information integration between freight company and terminal operator, which highlights theoretical contribution of the thesis findings. The inconsistency of information integration, which is sometimes considered as information sharing or knowledge sharing (Konings, Priemus, & Nijkamp, 2008), is approached by means of three concepts - collaboration, information sharing and IT implementation and adaptation. According to the authors, this notion provides better and deeper understanding of information integration in theory. The information flow, which gains less attention in IFT industry research (Heaver, 2011; Caris, et al., 2014), is studied and introduced to readers through the thesis. The process of finding the answer for the level of information integration between the freight company and terminal operator allows the authors to investigate the collaboration practice, information sharing performance and IT implementation and adaptation within the industry. The knowledge findings of these three elements fill the theoretical gap that is not fully studied in previous research (Caris et al., 2014; Caris, Macharis, & Janssens, 2013; Harris, Wang, & Wang, 2015). With the support of the theoretical framework, features of three elements of information integration and their levels are revealed. These findings provide a clear image of the status of collaboration, information sharing and IT implementation and adaptation regarding the defined population.

7.3.2 Practical Contribution

The result of medium level of information integration between two players in IFT industry provides an insight into information integration for executives of the field. This conclusion is to be taken as an opportunity for reevaluation of information integration in the organization. This suggestion is drawn from the analytical conclusion of tendency for misperception of information integration level among employees, as being proved during the research. The findings also highlight the concerns of information integration quality in the industry. The perception of high level of information integration, which is different from medium level that is concluded in the study, leads the companies to a situation where the players do not realize potential issues and information integration improvement opportunities.
7.4 Limitations

In order to read and interpret the conclusions drawn in this study, the readers are suggested to take some limitations into account. First of all, shortage of financial resources limits the broad outlook of the study. From this perspective, interviews and further observations cannot be conducted in a personal manner, as the authors do not travel to other countries during the research. Furthermore, not all the companies showed willingness to participate in this study due to some restrictions created by corporate policies and lack of time.

7.5 Own Reflections and Criticism

The initial idea of the study aims at examining information integration of IFT industry that includes many players within container transportation chain. During the investigation progress, the authors narrow down the scope of the study to two players - freight company and terminal operator. In this way, the authors avoid the complexity of the relationship between many players in the chain. Dyad perspective also opens various options for analysis chapter. The thesis findings regarding the level of information integration fulfills the authors’ expectations, which are stated in the beginning of the research. In other words, the process of investigation provides the deep insight into IFT industry in dimension of information integration, which satisfies the authors’ demand for obtaining knowledge regarding the field practices.

The process of information collection within the thesis strictly follows the ethical consideration that is stated in the methodology chapter. All the research participants are aware of the purpose of the paper and studied concepts. The authors respect the confidentiality policy of organizations and create the secure environment for the respondents. The final version of the thesis is sent to the interviewees as the consensus established in the first stage of contact.

During the study, the authors face lack of concrete information in research regarding the studied concepts. Therefore, the theoretical framework is extracted from the research of authors and operationalized according to the selected information integration elements and the industry. The operational framework is used in the research as an evaluation tool for the levels of information integration and its elements. The process of contact establishment appears as a challenge, as not many terminal operators and freight companies are willing to participate in
the thesis project. In some cases, research participants refuse to provide certain information when the interview is being carried out.

The reader is provided with large amount of information in the empirical chapter, as the researchers provide complete data collected during the interviews. This data is used further by the authors to come to the conclusion of features within the dyads. As it can be seen in the empirical study, some interviewees describe the container handling process without naming the exact features of information integration. The authors name these features in analytical chapter.

### 7.6 Future Research

Information integration is a well studied concept in many industries, whereas in IFT, the topic is moderately new and receives less concerns from scholars and companies that operate in the industry than other topics. The thesis approach on information integration within IFT industry suggests potential topics for further research in the industry, according to the authors. While this research focuses on investigation of the information integration level in the dyad of freight company and terminal operator, the research on information integration implementation within the dyad appears as an attractive research topic. Moreover, each element of information integration - collaboration, information sharing and IT implementation and adaptation - can fairly become a research topic itself for a deeper investigation. Furthermore, according to the research conclusions, IFT dyads appear to demonstrate different information integration levels depending on their corporate relations. In other words, organizations that are related in a business unit manner can show higher level of information integration. According to the authors, this notion deserves attention for further investigation. Additionally, it can be noted that there are only two players that are examined in this thesis. A study of information integration, which involves other players of the IFT chain, could be taken as an approach for a future research.
References


Information Integration in Intermodal Freight Transportation


Information Integration in
Intermodal Freight Transportation


**Interviews:**


Appendixes

Appendix A. Interview Questions

A.1 Questions for Freight Company

1. General questions and company description

1.1 What is your experience and responsibilities within the company?

1.2 What are the operations performed by your organization? What type of freight and transportation modes do you work with? What types of container handling processes are performed by the company?

2. Collaboration

2.1 Do you collaborate with terminal operator? If yes, can you describe it (e.g. collaboration consideration, planning activities and forecasting jointly with your partners)?

2.2 Who is the initiator of collaboration?

2.3 Is trust considered when your company collaborates with terminal operators? If yes, what role does it play?

2.4 Do you consider collaboration’s benefits and barriers? What are those in case of your company?

2.5 Do you consider having stronger collaboration in the future? How and in which dimensions (forecasting, joint planning, etc.)?

3. Information sharing

3.1 What information does your company collect and share (pick up, transport and deliver containers between customers and intermodal terminals/transport between terminal and terminal)? How do you collect this information? How this information support company’s operation?

3.2 What information does your company provide to terminal operator in Loading/Unloading activity?
3.3 What information do you receive from terminal operators regarding containers movement according to terminal activities (e.g. container transport to the terminal, container stacking, inter terminal transport, other activities)?

3.4 How does this information support the company’s operation?

3.5 What communication methods does your company use to communicate terminal operator (e.g. phone, email, fax, automatic electronic exchange of data, XML links)? what are the benefits of this method?

4. **IT implementation and adaptation**

4.1 What software system do you use for container handling? Do you use an ERP system? (e.g. SAP, IBM, Oracle, JDA, Sterling, etc.) If yes, which one and what are the benefits? If no, why not and have you considered using one?

4.2 Which IT tool (e.g. RFID) is used for information collecting and sharing and how are they implemented? What are the benefits? (e.g. track and trace your container). If not, what are the barriers? Do you consider other IT tools implementation for container handling?

5. **Conclusive question**

We have asked you questions regarding 3 elements (collaboration, information sharing and IT implementation and adaptation). These are the 3 elements of information integration between terminals and freight companies. How would you evaluate the information integration between your terminal and the freight companies you work with?

A.2 **Questions for terminal operator**

1. **General questions and company description**

1.1 What is your experience and responsibilities within the company?

1.2 What are the operations performed by your organization? What type of freight and transportation modes do you work with? What types of container handling processes are performed by the company?

2. **Collaboration**
2.1 Do you collaborate with freight companies? If yes, can you describe it (e.g. collaboration consideration, planning activities and forecasting jointly with your partners)?

2.2 Who is the initiator of collaboration?

2.3 Is trust considered when your organization collaborates with freight companies? If yes, what role does it play?

2.4 Do you consider collaboration’s benefits and barriers? What are those in case of your company?

2.5 Do you consider having stronger collaboration in the future? How and in which dimensions (forecasting, joint planning, etc.)?

3. Information sharing

3.1 What information does your company collect from freight companies during Loading/Unloading?

3.2 What information does your company give to the freight companies regarding container transport to the terminal, container stacking, inter terminal transport and other activities?

3.3 How do you collect this information? Does the collection method differ among the terminal processes? If yes, what is the difference?

3.4 How does information support the terminal’s operation?

3.5 What communication methods does your company use to communicate terminal operator (e.g. phone, email, fax, automatic electronic exchange of data, XML links)? What are the benefits of this method?

4. IT Implementation and Adaptation

4.1 What software system do you use for container handling? Do you use an ERP system? (e.g. SAP, IBM, Oracle, JDA, Sterling, etc.) If yes, which one and what are the benefits? If no, why not and have you considered using one?

4.2 Which IT tool (e.g. RFID) is used for information collecting and sharing and how are they implemented? What are the benefits? (e.g. track and trace your container). If not, what are the barriers? Do you consider other IT tools implementation for container handling?

5. Conclusive question
We have asked you questions regarding 3 elements (collaboration, information sharing and IT implementation and adaptation). These are the 3 elements of information integration between terminals and freight companies. How would you evaluate the information integration between your terminal and the freight companies you work with?

Appendix B. NCSP Map

Source: Google maps
(https://www.google.se/maps/place/Novorossiysk,+Krasnodar+Krai,+Russia/@44.7155345,37.7878025,11z/data=!4m2!3m1!1s0x40ee03bb38a719df:0x628956e1835d7aa3)