FInest – **F**uture **In**ternet **e**nabled optimi**s**ation of **t**ransport and logistics networks

D1.1

Transport and Logistics Domain Analysis

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Abstract

International transport and logistics operations are concerned with the planning and execution of the world-wide shipment of goods and people. The FInest project addresses this domain as a useful example for the Future Internet. Within this domain the FInest project has identified three different use case scenarios that characterize different aspects of transport and logistics operations. To properly understand these use cases, and to provide guidance to other work packages with the FInest project, it is essential that a comprehensive domain analysis be performed. Such an analysis facilitates consistency of understanding and hightlights opportunities for improvement. This document is being submitted as specified in the FInest Description of Work (DoW) as part of deliverable D1.1 – Transport and Logistics Domain Analysis. The FInest domain analysis will be revised and updated throughout the lifespan of the project as the work in the project progresses and insights and feedback regarding the domain is obtained.

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Document History

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Acronyms

ADSp	Allgemeine Deutsche Spediteurbedingungen
APQC	American Productivity & Quality Center's
C2K	Cargo 2000
CA	Cost Avoidance
CSD	Cost Savings Documentation
DoW	Description Of Work
FCL	Full Container Load
FMCG	Fast Moving Consumer Goods
FTL	Full Truck Load
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
ICT	Information Computer Technology
IMO	International Maritime Organisation
INCO	International Chamber of Commerce
ISO	International Standardization Organisation
JIT	Just In Time
KPI	Key Performance Indicator
LCCS	LOW Cost Country Sourcing
LCL	Less than full Container Load
LTL	Less than full Truck Load
MBE	Minority Business Enterprise
SCM	Supply Chain Management
SLA	Service Level Agreement
tdw	tons deadweight
TEU	Twenty Foot Equivalent Unit
UIC	Union Internationale Des Chemins De Fer
ULCC	Ultra Large Crude Oil Carrier
ULD	Unit Load Device
UNO	United Nations Organisations

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1. Introduction

The Future Internet Public Private Partnership (FI-PPP) focuses on the development of innovative open network and service platforms with generic common enablers serving a multiplicity of demand-driven use cases in "smart applications". The work in Objective FI.ICT-2011.1.8: Use Case scenarios and early trials, focuses on vertical use case scenarios whose intelligence, efficiency, sustainability and performance can be radically enhanced through a tighter integration with advanced Internet-based network and service capabilities. The work includes use case characterization; specification of platform requirements; development and technological validation prototypes, and large scale experimentation and validation.

In the FInest (Future Internet Enabled Optimisation of transport and Logistics Business Networks) project we aim at developing such an infrastructure on the basis of the Future Internet technologies for the Transport and Logistics (T&L) domain. Modern transport & logistics is often a highly distributed inter-business activity spanning across several countries with each of the involved business partners aiming at optimizing their individual, commonly complex supply and production chains.

The FInest project addresses international transport and logistics businesses that are concerned with the planning and execution of world-wide shipment of goods. These companies operate in a highly competitive industry, one that demands novel ICT solutions for enhancing their inter-organizational collaboration in cooperative business networks.

1.1. Work Package 1: Domain Characterization and Requirements Analysis

The overall goal of **Work Package 1: Domain Characterization and Requirements Analysis** is to determine the business requirements for the next generation of ICT solutions for the transport and logistics domain, and to ensure the suitability of the technological solution that shall be designed by the project team for satisfying these business needs. In the context of the FInest project, logistics is considered to be the summation of single tasks and actions within the supply chain. It includes all supply activities from planning through execution and delivery completion.

To ensure a common understanding by all users of the results of the FInest project, the domain analysis has been conducted with a view towards the development of a shared understanding of the central domain elements. The identified business requirements will form the foundation for designing the technological solution to be developed in WP3 of the project and the conceptual prototypes to be designed in WP5 – WP8. The use case scenarios, defined in WP2 of the project, will be used to demonstrate the ability of these technical artifacts to address the identified business requirements.

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The specific objectives of this work package are, therefore, to:

- Establish a common understanding of the important elements of the transport and logistics domain,
- Identify the business challenges arising in transport and logistics, and define a detailed set of business requirements for the next generation of ICT solutions,
- Provide a comprehensive state-of-the-art analysis on ICT solutions for collaboration and integration that are currently employed in the transport and logistics domain,
- Review and assess the design of the envisioned technological solution with respect to its suitability for satisfying the identified business requirements, and
- Investigate business models and identify business opportunities for the envisioned technological solution for involved industries.

1.2. Task 1.1: Establishing a Common Domain Understanding

The **Task 1.1: Establishing a Common Domain Understanding** focuses on developing a common understanding amongst consortium members of important concepts within the transport and logistics domain. Taking existing industrial standards into account, elements like terminology, meanings, operating descriptions and other relevant information (size, volume, flow, etc.) will be standardized so that each member of the consortium will be able to clearly understand what is meant when a particular transport and logistics term or process description is used. This is a pre-requisite for designing appropriate ICT solutions and facilitating broad industrial adoption.

1.3. Deliverable D1.1: Transport and Logistics Domain Analysis

This report presents **Deliverable D1.1 Transport and logistics domain analysis**, which is one of the two planned deliverables from task T1.1 (Establishing a Common Domain Understanding). Despite the many different definitions employed for various terms used in the transport and logistics domain, some key terms appear to enjoy definitions that are more or less universally employed in the industry. To achieve the objective of establishing a common domain understanding, this report examines the definitions currently being employed in relevant research projects by partners in the Finest project or used by the project's domain partners and develops from these terms standard definitions for the activities, actors and entities employed in the domain. The following sections of the report describe the sources of information for defining the domain, identify critical domain entities and provide an overview of follow on activities that will be employed to deliver a detailed set of domain requirements. In addition, a description of how the domain analysis presented in this report will form the foundation for documenting the current information technologies employed in the industry is also presented.

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1.4. Research projects

This section of the report presents the main external sources of information used for building the Domain Analysis. A summary of the contribution from each reference project is given at the end of the section.

1.4.1. ARKTRANS

ARKTRANS is the Norwegian multimodal framework for intelligent transport systems (ITSs). The ARKTRANS framework addresses the entire transport sector. The specifications are valid for all transport modes (road, sea, rail, and air) and cargo types including passengers.. ARKTRANS provides a multimodal (common to all transport modes) specification of responsibilities, functionality, processes, and information flows in the transport sector.

The ARKTRANS reference model decomposes the transport sector in five sub-modules, and specifies the main responsibilities related to each sub-module (orange boxes in the figure below).

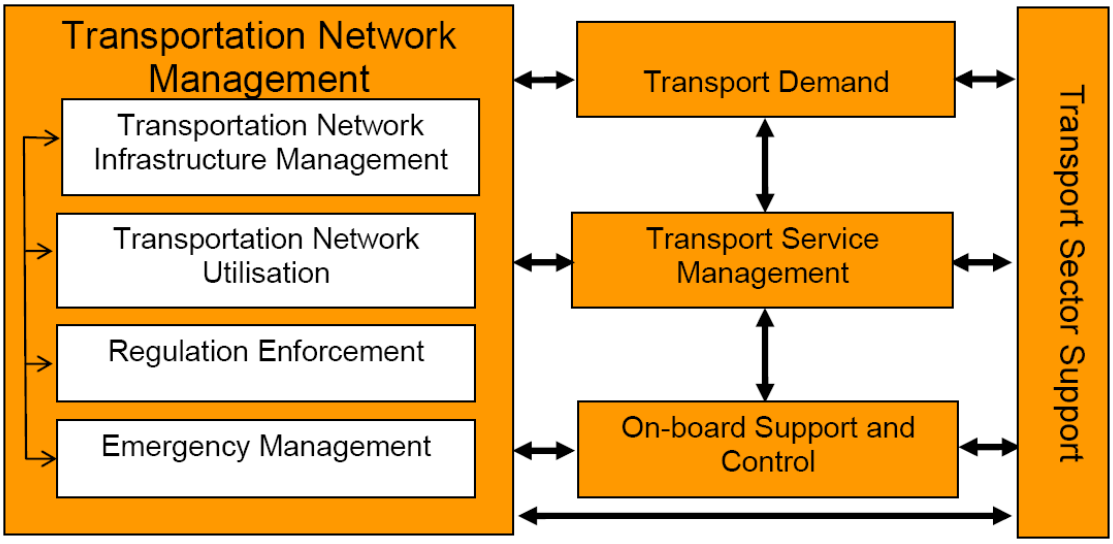

Figure 1: ARKTRANS Reference Model and upper level functional decomposition of Transport Network Management (Source: SINTEF, 2004)

According to the ARKTRAS reference model:

- The *Transport Demand* sub-module supports the transport user (a traveller, one who would like to send or receive some type of cargo) or entities that are representing the transport user (travel agency, forwarding agent). This sub-module includes services and functionality for pre-trip planning, transport order initiation and follow-up.

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- The *Transport Service Management* sub-module supports the transport company or the fleet operator. It includes services for planning and preparation of fleet operations and fleet management services for both freight and human transport.
- The *On-board Support and Control* sub-module encompasses functionality that resides on-board the transport vehicle. This is functionality that is used to monitor and control the driver, cargo, passengers or the transport vehicle itself. These services also assist the driver and support fulfilment of the transport operation.
- The *Transport Network Management* sub-module encompasses functionality related to the transport network (roads, rivers, railroads, air corridors, etc.). Traffic management is an important part of this sub-module's services as well as information services for tracking and tracing.
- The *Terminal Management* sub-module encompasses functionality related to terminals where goods and passengers are transferred between different transport modes.

1.4.2. FREIGHTWISE

The European Union 6th Framework project FREIGHTWISE builds on the framework developed in the Norwegian ARKTRANS project. The objectives of the FREIGHTWISE project were to develop processes to facilitate the easy exchange of messages between trading partners, ease decision making through the creation of automated decision making systems based on business rules, and enhance transport planning by integrating traffic and incident information with planning and scheduling systems. The FREIGHTWISE project utilised a subset of the ARKTRANS framework to address these objectives (FREIGHTWISE, 2006).

1.4.3. E-FREIGHT

The E-FREIGHT project is European Union 7th Framework project that builds on the work of the FREIGHTWISE project. E-FREIGHT focuses on developing efficient electronic market places for the operation of inter-modal transport activities within the European Union. In addition, the E-FREIGHT project will attempt to define and obtain approval for a single transport document for all modes of freight to ease the information processing requirements for shipping goods. Finally, the E-FREIGHT project will attempt to create a next generation single window security process for managing transport related risks (E-FREIGHT, 2011).

1.5. Prior project contributions

All of the research projects referenced previously have attempted to provide a clear characterization of the transport and logistics domain, but from a particular view point. Of the three projects the ARKTRANS project provides the most general or broad overview of the domain while the FREIGHTWISE and E-FREIGHT projects provide more detailed descriptions of

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certain elements of the domain. With respect to the FInest project domain information from each of these prior efforts is relevant.

From the ARKTRANS project a broad characterization of the transport domain can be obtained. This characterization, embodied in the five sub-modules of the ARKTRANS framework, covers is a comprehensive manner the key transport related activities of the domain. This model does not, however, address certain logistics activities that are also critical to the domain. Activities such as longer term warehousing operations, LTL and parcel cross docking operations, port terminal operations and other similar activities are not clearly addressed in the ARKTRANS framework although they are relevant components of the overall transport and logistics domain. The FInest project must include these logistics activities in its definition of the domain and thus will build on the ARKTRANS framework to ensure that these activities are addressed.

The FREIGHTWISE project digs deeply into the requirements for effectively and efficiently communicating amongst freight transport organizations. Its definition of what is required to exchange information in an electronic format between trading partners, the process flows necessary for the efficient interchange of this information and the standard formats for exchanging information are a useful foundation for inter-company message exchange requirements for the FInest project. However, the narrow focus of FREIGHTWISE on only the transport element of the domain once more requires the FInest team to add to their work to properly characterized the broader domain of transport and logistics being addressed in the FInest project.

Finally, the E-FREIGHT project provides valuable insights into electronic trading that will assist the FInest team in properly characterizing the cloud based services it is attempting to develop based on Future Internet technologies. In addition, the efforts of the E-FREIGHT team to establish a single transport document standard and the next generation processes for single window activities can only assist the FInest team in its efforts to simply supply chain collaboration processes. However, the focus of E-FREIGHT on current generation technologies limits its full application when examined in light of Future Internet and cloud based services. The FInest team will build on E-FREIGHT's insights, but must also chart a different technological course for addressing future domain related issues.

2. Domain Analysis

2.1. Introduction

The logistics and transport domain covers all factors associated with the transport and storage of goods. Within this domain a number of actors perform different roles as goods are sourced, shipped, stored and delivered. The modes of transport used in the domain have evolved over centuries of use. As technologies have advanced shippers have moved from human and animal carriage, to wheeled conveyances, ships (human powered, to wind, steam and diesel

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power), trains, motorized vehicles, and aircraft. Future evolutions may include rocket powered transports as commercial services in space develop.

As trade advanced and demand for goods from increasingly distant locations arose, trade lanes developed. These lanes inevitably crossed borders and the practice of collecting tolls and declaring what was being transported developed. The ad hoc evolution of these practices led to stark differences in how goods were handled at border crossings and these differences persist today.

The complexity of trading between towns, regions, states and different parts of the globe has led to the development of intermediaries that provide services that attempt to ease the burden of shipping goods around town or around the globe. These Logistics Service Providers (LSPs) provide customs clearance services, customs brokerage services, freight forwarding and consolidation services, contracting services, planning services, visibility to freight movements, transport and storage of goods and a host of other services to buyers and sellers of goods. These actors, whether third parties or in-house entities, have developed the expertise to allow trade to grow and consumers to benefit from ever increasing product diversity and decreasing costs. These entities provide the knowledge necessary to facilitate what has come to be called today global supply chain management.

To better address the complexities involved in sourcing, shipping and consuming goods on a global basis, complex ICT solutions have been developed by LSPs to manage supply chain operations. These solutions have generally been developed by individual LSPs to address particular problems peculiar to their business models and thus are highly fragmented in their design. This fragmentation has created benefits for the LSPs as the cost of integrating several LSPs into an organization's IT infrastructure is very high so customers tend to become locked in to one or only a few service providers. Smaller, less well financed service providers are thus disadvantaged by this fact.

The aim of the FInest project is to design a cloud-based ICT platform that facilitates the real time collaboration amongst supply chain partners in an easy to use and low cost manner so that the all players, whether small or large, can participate in a supply network. One of the key activities that the project will undertake in the design of this platform is the identification of the current capabilities of commercially available supply chain management ICT. This analysis is part of the deliverable D1.3 from the project that is due in month twelve of the project. This domain analysis will form the system boundary within which this ICT analysis will occur.

Apart from describing the various modes of transport, equipment used and stakeholders involved, this deliverable presents issues associated with contracting, operations based on service level agreements and key performance indicators as well as terms of trade (Incoterms) and payment. After describing these constituent components of the transport and logistics domain a domain business model will be developed that the FInest team will use as a reference throughout the project.

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2.2. Relationship with other Work Packages

Work packages 1 and 2 (WP1 and WP2) of the FInest project are concerned with collecting general domain requirements from the domain-partners involved in the project. Domain requirements are relevant throughout the entire project as the FInest project is – in contrast to many other research projects – not technology driven, but domain driven. This means that domain requirements define the need for certain technical services (they "pull" the proper technology from designers). These services are not pre-defined and "pushed" onto the domain partners who are then forced to fit them to their business requirements if they can. Additionally, WP1 and WP2 define concrete use cases that will be used to demonstrate the effectiveness of the FInest extension to the FI PPP Core platform and that address the business requirements of the transport and logistics domain. WP1 and WP2 provide the essential inputs for all other work packages in the FInest project as displayed in Figure 2.

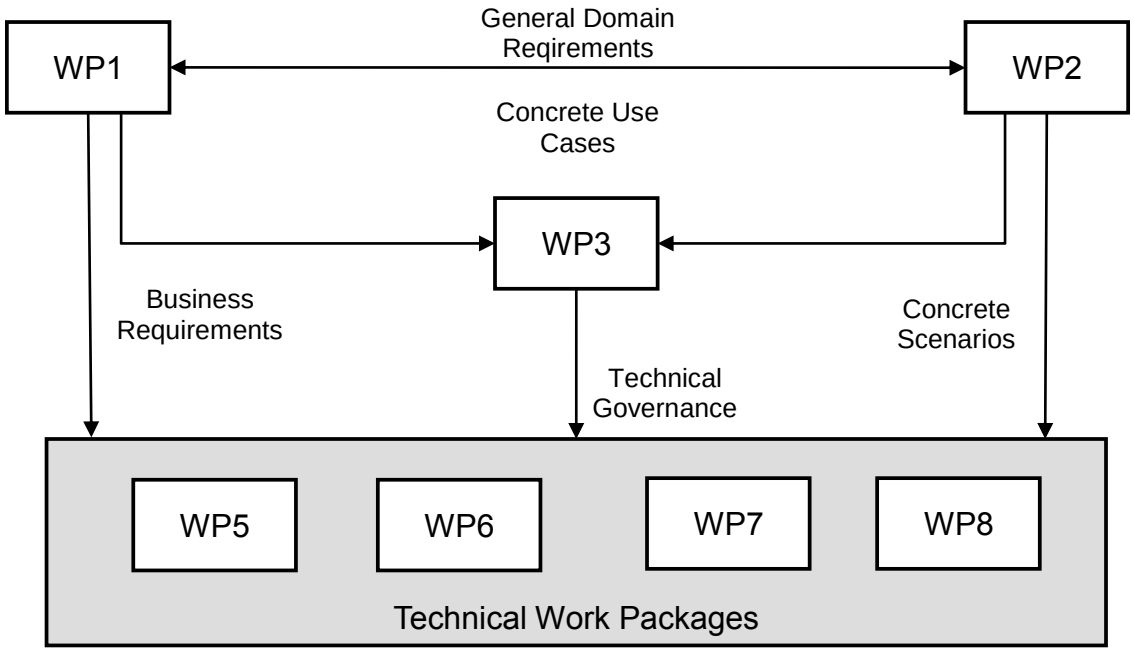

Figure 2: Interactions between WP1-WP3 and WP5-WP8

WP1 is concerned with eliciting and documenting business requirements and to understand the ‚State-of-Affairs' of current ‚ICT systems for collaboration'. Those Business Requirements provide the overall design goals and rationale for the development of the technical solutions in WP3, 5-8.

WP2 is concerned with the definition of use case scenarios, which serve two main purposes: They support the refinement and illustration of the business requirements and "state of affairs" (from WP1) and they are used as demonstration, test and evaluation scenarios for assessment of prototypes (in WP3) and the design of the experimental setup (in WP4). In

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addition, WP2 provides a methodology, that is used by WP5-8 to provide a refined “as-is-“ and “to-be-“situation analysis.

2.3. Domain Process Analysis Approach

The FInest project employs a process focused approach for documenting particular domain activities. This approach segments a logistics process into four distinct activities. These activities are:

1. Sales and marketing of the service;
2. Planning execution of the service;
3. Execution of the service; and
4. Completion of the service.

An example of how this approach is used for organization of information concerning domain processes is shown in Figure 3 following.

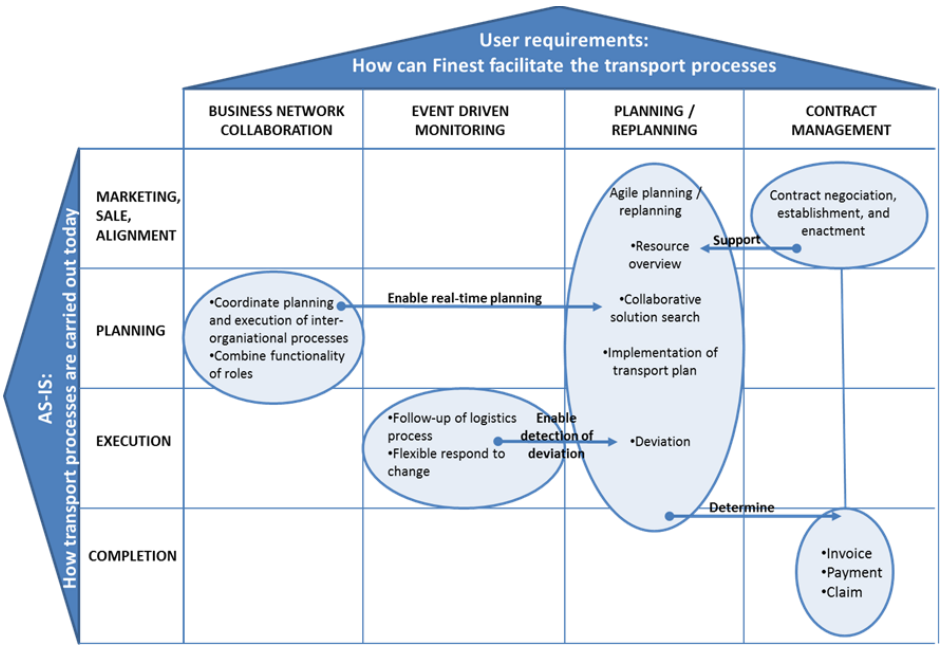

Figure 3: FInest domain mapping approach

2.3.1. Sales / Marketing

Marketing, Sales, and Alignment processes are concerned with creating contact between actors that have a need for transport or logistics services and those who can offer transport and logistics services that fulfil the demand. This activity consists of the following steps:

- publishing of needs or offered services,
- establishing contact between the parties,

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- agreeing on the terms of the service and
- sale of the service.

As discussed in the previous section of this report, these steps are the same steps employed by most road freight exchanges.

2.3.2. Planning

The provision of transport and logistics services is planned and managed based on actual and forecast demand, information about the transportation network infrastructure, and traffic conditions. Planning includes decisions about:

- routes,
- schedules,
- service types, and
- use of resources.

Shipping consolidation and load/trip planning is the planning of the physical loads for placement in a transport unit (truck trailer, sea freight container, ULD, etc. depending on the mode of transport). This type of planning assigns shipments (goods) to a transport mode, taking into account constraints like pickup and delivery time windows and allowed combination of goods. The trip planning is used to define the most optimal trip, based on geographical maps and plans. Combining both load and trip planning is necessary to create the most optimal transportation trip.

Load design means to plan how the goods will be stored in the container (three dimensional). Design is done based on criteria such as sequence of loading and unloading and stackability of the products. This process can include load design for pallets using alternative stacking patterns, driven by product, customer and transport unit data/constraints.

Route planning is based on the created trip. The actual route is determined by customer delivery requirements, carrier network design and more granular information depending on the type of transport being used.

In case the planner's own equipment is used to execute the actual shipment, the planning process needs to allocate loads appropriate to the equipment and schedule the correct operating personnel to the equipment and routes. Constraints that typically can be taken into account are operating hours, the current location of personnel, equipment and the condition of the transport equipment.

Carrier selection can include transport mode selection and the selection of the actual carrier. In its most basic form the planner assigns a transport mode and/or carrier to the shipment. Decision rules might be used that simply the selection criteria such as having an approved carrier for each mode or lane. It is also possible that carrier selection is supported by

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tendering of loads amongst contract carriers or via public tendering on the web as discussed for freight exchanges.

2.3.3. Execution

The Execution phase begins when work processes are initiated in accordance with the execution plans and ends when the execution is completed or cancelled. The execution of the operations includes movement of goods, cargo handling, document handling, monitoring and control of operations and goods, supporting effective coordination and accomplishment of the whole transport chain. This may include transport and terminal operations managed by several logistics service providers (LSPs). This phase also deals with detection and management of deviations.

Order entry and consolidation is the registration, validation and management of orders. The exact content differs considerably depending on the user role: either shippers, LSPs or carriers. For a shipper it is the key to register the relation between the customer order and the transportation/orders/deliveries that are being created as part of the fulfilment process.

A logistics service provider typically receives transportation orders from customers, either by phone, fax, email or electronically. Depending on the activities being outsourced and the IT solutions used, LSPs and carriers might only get a transportation order, possibly with a reference to a client customer order.

When dispatching the carriers or internal execution resources need to be informed. Confirmation may need to be obtained, especially when subcontracted carriers are used. At this point additional information, such as vehicle identification and operator information might be part of the confirmation.

The process used to record order status information related to the pick-up/collection and delivery of shipments is sometimes called the visibility or track and trace process. This process is used to monitor the execution of transportation and logistics services for every order. Information captured during this process can be used for financial settlement later.

Global logistic execution/customs and transport documentation generation processes support international transportation with trade compliance information for import and export. These processes provide compliance information about rules and regulations and support printing of specific import/export documents.

2.3.4. Completion

The completion phase includes the agreed completion of the services (e.g. delivery of the transported goods at the destination), handling of payment and claims when the actual service has deviated from the agreed terms. Also, while the handling of payment for services may come at any time in the process (e.g. prepayment), it fits in the completion phase from a logical viewpoint.

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Figure 4 below shows how information and activities link per the description above.

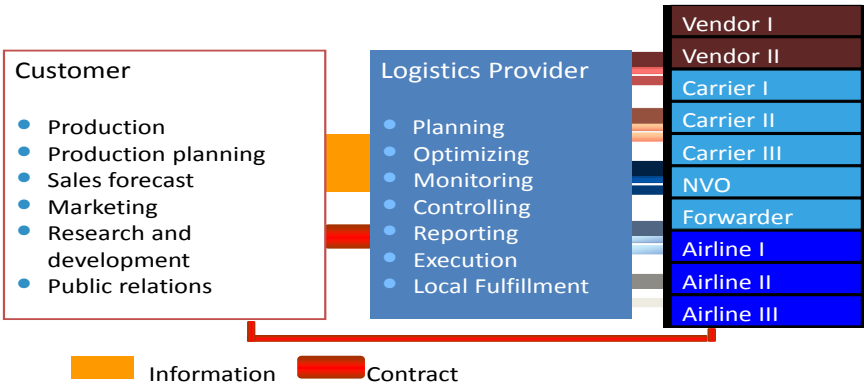

Figure 3: Transport Management Process (Source Kühne+Nagel)

2.4. Domain Overview

The transportation and logistics domain has experienced an unprecedented level of growth over the past thirty years. Prior to 1980 the transportation industry consisted of a highly fragmented set of operators providing trucking, rail, warehousing, barge, and some international freight services. The non-captive logistics service providers in the industry were largely unsophisticated independent operators focused on local, regional or, at best, national services. The large and sophisticated international logistics companies that dominate today's global freight activities did not exist. The rapid growth of the industry is a direct consequence of growth in global trade. Trade growth has been rapid over the past thirty years primarily because of trade liberalization, infrastructure investments, advances in information technologies and competition in first world countries (World Trade Organization, 2008). Trade today accounts for an ever increasing amount of the gross domestic product of all Western countries, exceeding 25% of GDP for the United States and 50% of GDP for Western Europe (OECD, 2011).

2.4.1. Industry Trends

The transport and logistics industry is facing a number of challenges that are a direct result of globalization and the rapid development of countries such as Brazil, Russia, India and China. These challenges can be broadly grouped into five areas. These grouping are:

1. Costs – transportation and logistics is a highly competitive industry with margins for traditional services rarely exceeding 4% of turnover;

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2. Risks – increasing weather, geological, geo-political and supply uncertainties are creating significant problems as supply chains grow longer and more complex;
3. Demographics – changing global demographics are driving companies to move into non-traditional markets where supply chain infrastructures are less mature and operating practices less advanced;
4. Energy – length, speed and tonnage transported determine the energy consumption of supply operaitons. As supply chains have grown longer and more complex their demands for scarce energy resources has increased raising risks associated with energy price variations as well as availability;
5. Environment – transport and logistics operations have a large impact on the environment because of CO2 emissions from the combustion of fossil fuels and wastes from packaging and operations.

Each of these challenges will be detailed in the sections that immediately follow.

2.4.1.1. Cost

Transportation and logistics firms operate in a highly competitive environment where margins are thin (generally less than 5%) and customer demands for service are high. These factors make it exceedingly difficult for logistics service providers to invest in novel technologies that could address some of the other challenges that they face while still meeting customer requirements that are based on cost and service level. A number of studies have indicated that the logistics services industry is becoming a commodity industry where competition is based solely on price and that innovation is something that suffers because of this (Cahill, 2007). Given the complex nature of logistics service contracts with their tight service level requirements and pre-formulated key performance measures, it is not too difficult to understand why LSPs might not wish to focus on any other performance parameter except cost.

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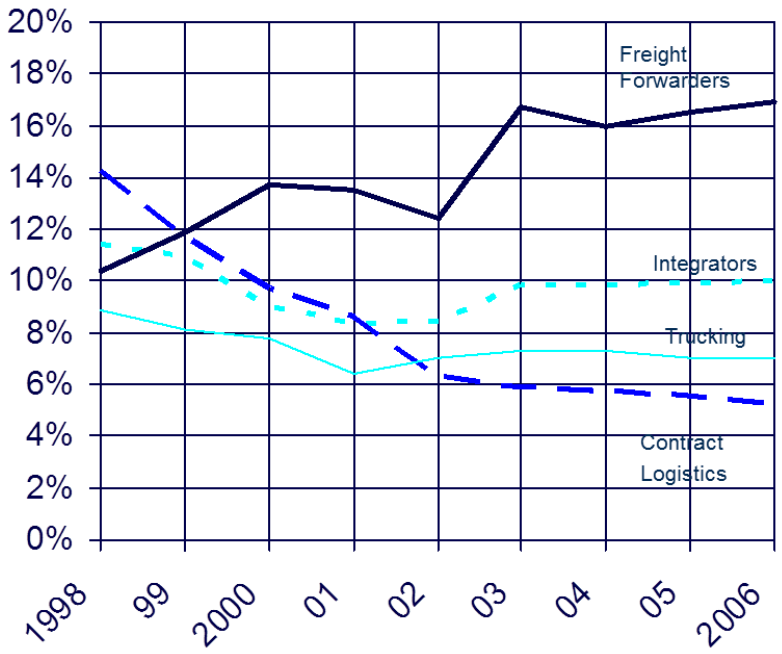

Source: Kuehne + Nagel and McKinsey

Figure 5: Logistics Service Provider aggregate profitability by LSP type

The result of competition and customer cost pressure can be seen in the consolidation of the industry over the past thirty years. Whereas thirty years ago companies like DHL, Kuehne + Nagel, Panalpina, TNT, Agility and Toll were at best strong regional players, today through mergers and acquisitions these companies are international power houses in the global logistics market. The scale and scope of these companies provides them with an advantage when competing against smaller regional players and leads to these large companies enjoying higher profits than their smaller competitors (Korom, 2008). Unless the playing field can be leveled, the cycle of logistics consolidation and the elimination of smaller logistics service providers will remain the norm as cost and competitive pressures continue to build.

2.4.1.2. Risks

As supply chains have grown in length and complexity the risk of disruption has increased. Long chains are exposed to more environmental, geological, geo-political, regulatory, and supplier risks simply because of their length and international character. These long supply chains are also more fragile due to the desire by all supply chain operators to reduce inventories to avoid obsolescence and capital costs. Any delay or breakage in the flow of goods through these long chains quickly consumes the minimal inventory stocks in the chain and can result in significant lost sales revenue.

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The concept of risk in supply chain operations has gained significant attention in the past few years. Initially, this was a result of the terrorist attacks on 11 September 2011. Focus in the risk management literature at this time was on how to avoid disruptions should another attack similar to that on 9/11 occur and cause international transport operations to be disrupted. In addition, risk management began to focus on certification of cargos so that they could pass swiftly through the new inspection processes that were established by countries after the 9/11 event to ensure that containerized shipments did not contain explosives or other weapons that might be used in a terrorist attack.

Work performed by RAND, a US based research and development "think tank", is indicative of the thinking that typifies supply chain risk considerations based on security issues. RAND characterized international supply chain operations as having functions in the secure and reliable movement of goods (RAND, 2004):

1. Efficiency – supply chain operations have evolved and been improved through the use of containers, container shipments, automated handling operations, etc. to ensure that more goods can be moved faster and at lower overall costs throughout the world;
2. Reliability – shipments must be delivered as and when expected without loss due to theft of damage;
3. Transparency – the goods moving through a supply chain must be legal to transport and traceable by shippers, consumers and regulatory bodies;
4. Fault tolerance – the supply chain must be capable of absorbing failures in links in the chain without disrupting the overall flow of materials in the chain;
5. Resilience – should a fault occur in any link in the chain, the supply chain must be able to quickly return to normal operations after the fault has been corrected.

The reliability, transparency, fault tolerance and resilience characteristics of a supply chain design are directly related to the ability to manage security and risk in a supply chain. Efficiency characteristics, however, may conflict with these other four characteristics depending on the focus of the shipping organization.

More recent considerations of supply chain risk have emphasized environmental and geological disruption potentials. These considerations have arisen because of the recent disruptions to supply chain operations caused by the SARS flu epidemic, Icelandic volcano eruption, the Japanese tsunami and a number of severe weather events across the globe (Cranfield, 2003).

Risk issues require supply chain operators to trade off efficiency considerations against effectiveness considerations. Efficiency argues for single link designs and lowest cost approaches to operations. Effectiveness considerations require the supply chain operator to take into account potential disruption probabilities and develop designs that allow the supply of goods to continue to flow even when a disruption occurs. No matter what tradeoffs are made in the design of the supply chain, the operator must be able to monitor the flow of

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goods in real time so as to be able to react to any disruption and re-plan the goods flow to come as close to contractual commitments as is possible.

The ICT required for this type of real time tracking and event monitoring is complex and costly due to the unique nature of supply chain operations and the multiple entities that must be integrated to track a single shipment of goods from a source location to a destination. Small players, and even many large players, in the supply chain do not have the capital or technical capabilities to fully address these complexities. This fact means that a significant portion of the international supply chain is "dark" and the risk of disruption from any cause is much higher than most shippers and consumers realize.

2.4.1.3. Demographics

The changing world demographic situation, where the populations of traditional "first world" countries are getting older while the populations in emerging markets are much younger (Figure 6), has significant implications for the focus and type of transport and logistics operations in the future. An aging population requires less long lasting capital goods (washers, dryers, etc.) and more health and leisure time goods. Younger, growing populations require new capital goods, more electronic equipment, more automobiles, etc. In other words, the aging world population means that the growth of transport and logistics activities will decline in old "first world" countries and expand in new and emerging markets.

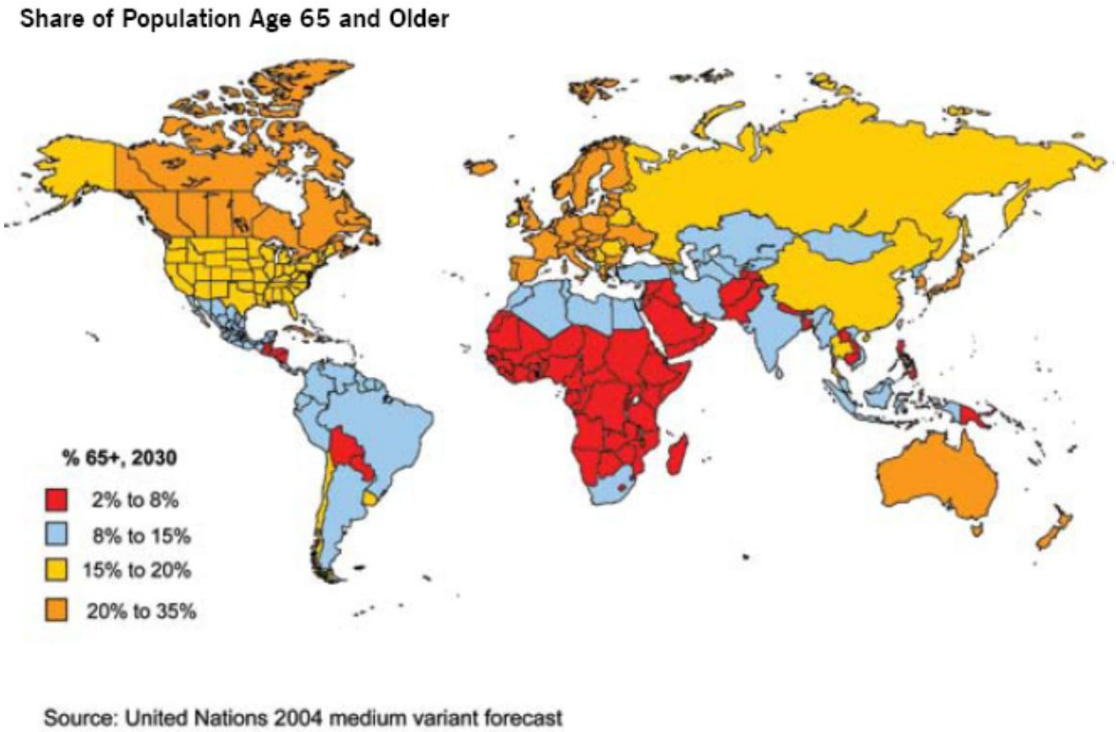

Figure 6: World population age distribution in 2030

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The implications of this change in focus is that international transport companies that already have a presence in emerging markets will share disproportionately in the changing focus of business activity. Smaller, more regional companies that may have been strong in their local markets will have a difficult time participating in this changed world unless new forms of technology are developed that allow them to more easily bear the cost of the investments needed to move out of local markets and into new and emerging markets.

2.4.1.4. Energy

A fundamental fact of freight transport and storage is that it requires energy. Energy is required to move freight, to cool perishable goods, to transmit information, to control storage environments, to deliver freight and to do just about any type of value added service related to the freight being moved. As economies grow they need to move more freight and this fact, coupled with the growth rate of the economy, leads to increasing energy demands from the transport and logistics sector. This fundamental physical fact is the primary reason why all projections for energy consumption in the transport sector indicate that energy demand from this sector will increase into the foreseeable future (Figure 7)

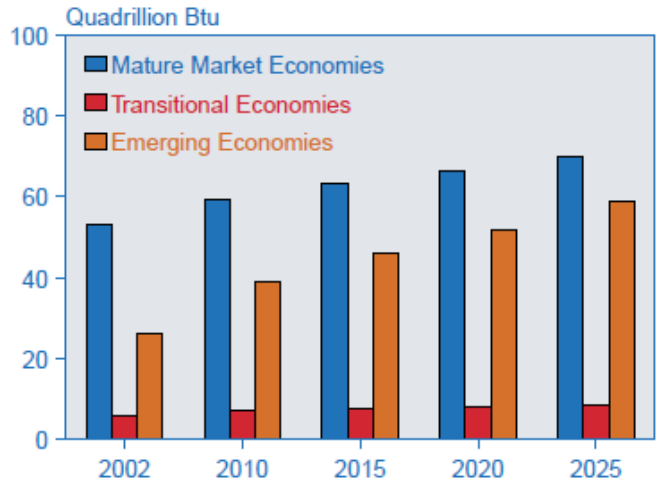

Figure 7: Transportation energy demand forecast by geographical region

Several issues arise from this fact. The first issue, which will be discussed in the following section, has to do with the negative environmental impacts of increasing energy demand by the transport sector. The second issue has to do with the volatility of energy prices and the rising trend these prices exhibit.

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Figure 8 following shows the historical price of crude oil from 1947 through 2009. The chart provides an indication of the volatility of the cost of oil over this period. The interesting observation from the chart is not only the rising cost of oil, but the increasing volatility of its price. Projections for future price increases and volatility levels indicate that these trends will increase in the future (Singleton, 2011). Increasing volatility in fuel prices implies that transportation and logistics operations, which have already been described as highly cost driven, will face the twin problems of pricing uncertainty and cost pressure.

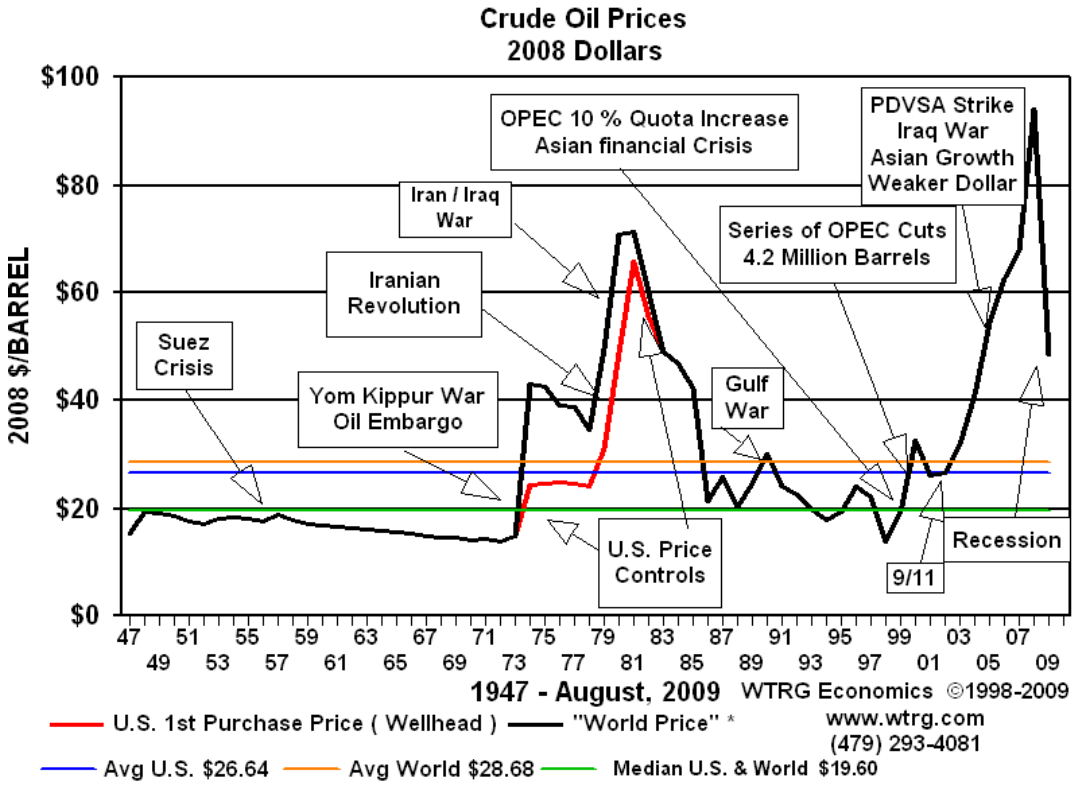

Figure 8: Historical oil price chart

Transport and Logistics companies that are of sufficient size to weather the economic uncertainties caused by fuel price volatility and can pass on certain of these costs to customers are in an advantageous position to capture an increasing amount of international transport activities. This fact arises since the greatest addressable impact of fuel costs for customers is in the cost of international shipments where changes in mode can dramatically lower energy related costs. Large transport companies have the relationships and ICT capabilities to facilitate these changes in a rapid and seamless manner while still providing customer service levels acceptable to major shippers. Smaller players without the scale or scope capabilities of the major transport companies have less freedom in making similar changes for their customers.

2.4.1.5. Environment

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Environmental considerations are becoming increasingly important in the transport and logistics domain. Customer and regulatory demands for lower CO2 emissions are forcing LSPs to invest in more environmentally friendly technologies, redesign warehouses and rethink customer network designs. In addition, congestion and noise problems are forcing a rethinking of high street delivery models.

Well capitalized transport companies are renewing their vehicle fleets and upgrading to the latest engine technologies in order to comply with current or anticipated future regulatory requirements. New vehicle telematics systems are being installed in transport fleets to monitor and manage vehicle driving parameters to ensure that the most efficient driving processes are employed and that regulatory requirements for vehicle routes are adhered to. New delivery planning and routing systems are being deployed to ensure that the optimum routes for delivery of goods are followed and that vehicle load factors are maximized. Finally, entire transport networks are being re-examined and redesigned to accommodate the realities of energy constrained and environmentally friendly goods transport.

All of these changes in capital stock, monitoring and planning systems, personnel practices and network designs require resources. Time, money, qualified personnel, etc. are all necessary to allow transport and logistics companies to successfully address the implications of operating in an environmentally constrained and regulated world. Large organizations with the internal resources necessary to address the demands of these new market realities are doing so. Smaller organizations that operate with more limited resources are finding these demands to be too burdensome to pro-actively address and are taking a “wait and see” approach to changing their business practices. Unfortunately, such an approach is neither good for the environment or the small LSPs as both costs and environmental impacts rise with delay. Large LSPs are once more advantaged based on their access to resources.

2.5. Domain Operations

International transport and logistics activities are both relatively simple to understand and complex to execute. Simplicity arises because the operations primarily involve moving and storing goods. What could be more simple?

Complexity arises because of the diversity of goods to be moved and stored, the variations in country infrastructure and logistics maturity, border and customs differences, modal operating variations, differing customer requirements and expectations, differing customs within the various regions of operation, different governmental regulations in the countries through which goods pass, and a host of other operating factors. Figure 7 following provides a stylized view of a “typical” international shipment of some good from one country to another.

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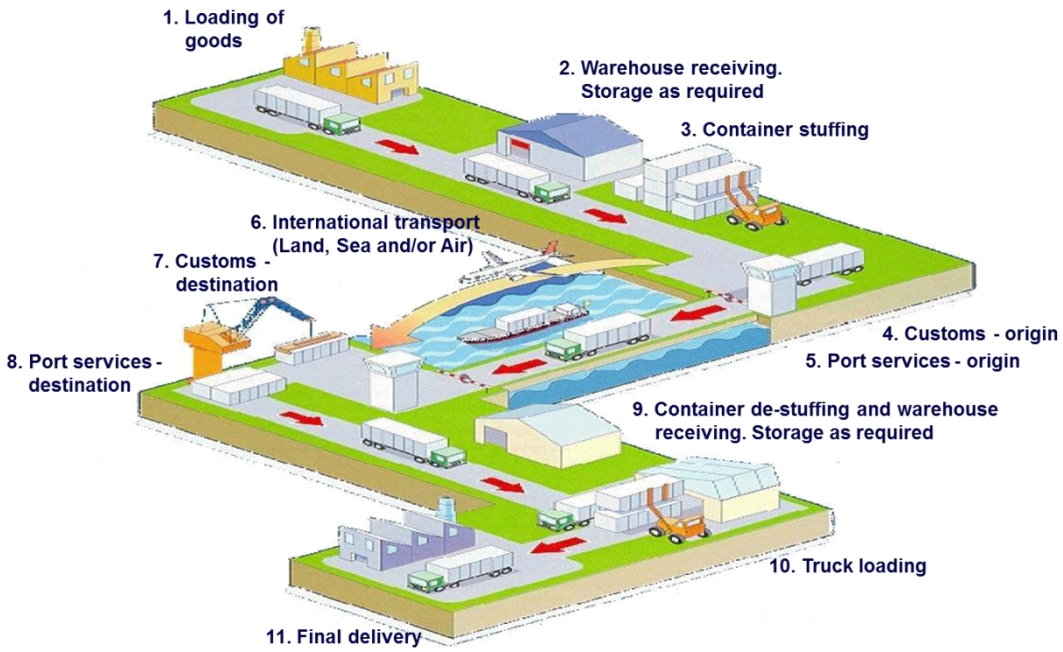

Figure 9: Simplified view of an international goods shipment process

While the process shown in Figure 9 indicates that the international shipment begins with a loading of goods, this is only the beginning of the physical portion of the shipment. Prior to any loading of goods a customer must decide on who will handle their shipment. Once this decision has been made the customer and the logistics service provider must then determine how the goods will be moved from the sourcing location to the destination location. This discussion constitutes the operational network design component of a transport contract. Physical network designs (i.e., the design of plant and distribution locations are done prior to, and separate from, the physical execution activities that are the focus of the current discussion).

Once a decision on how the goods will be transported has been made, the shipper must determine how payment and insurance for the goods will be handled. This involves defining ownership terms, setting up banking relationships and creating trigger points along the supply chain for at which certain financial transactions occur.

With the back office operations almost complete, the goods are readied for transport. However, before the goods can be officially handed over for pickup and transport a host of documents must be produced. These documents include shipping documents that describe the goods to be transported, international customs declaration documents defining what the goods are, who owns them, where they are being shipped, where the goods were manufactured, the value of the goods and other information necessary to clear customs at the source country and to be allowed to enter the destination country. Besides the customs documents, certain tax documents must be filed for delivery to the appropriate authorities so that duties and taxes can properly be handled.

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With all documents prepared and distributed to the appropriate handlers for delivery, the goods can be picked up. The LSP must arrange for the pickup and transport of the goods to the port of departure. This may involve contracting with a local trucking company to pick the goods up or using an owned trucking operation to pick the goods up and transport them to the port.

At the port, unless the manufacturer of the goods "stuffed" the goods into an appropriate onwards journey container, the LSP will need to put the goods into a standard international freight container appropriate for the onward journey. Container stuffing is performed at the LSP's local container freight station and may require the LSP to map the contents of the container for unloading operations at the destination. At a minimum the LSP must generate an inventory list of what is in the container for customs clearance and transport company acceptance for the onward journey. This inventory list is called different things depending on the transport mode (airway bill, bill of lading, etc.).

The loaded container is transported by the LSP to port (air or sea) or picked up by a trucking firm if land based carriage is planned. Paperwork is checked by the contracted onward carrier and, if all is in order, the container is loaded at the port onto the onward transport vehicle.

Upon arrival at the destination port paperwork is transferred to the local authorities and the goods are removed from the vehicle and put into port storage until the paperwork is verified. If all is in order the goods are released and the LSP's prearranged local pickup contractor picks up the container and moves the goods to a distribution facility. At the distribution facility the goods may be simply placed on another vehicle for full container shipment to a final destination or the container may be opened and the goods integrated with other goods going to different locations. If such a breakdown of goods is performed additional shipping paperwork must be generated so that the items can be tracked to their destination.

Once the goods have been delivered to their final destination a proof of delivery receipt is obtained by the delivery vehicle driver and the physical delivery process is concluded. Of course, follow on paperwork processing continues as bills are received for services rendered, audits performed to determine that the bills were correct and payments made.

The simple process described above indicates that international transport and logistics activities fall into four broad categories (Figure 10). These categories, the physical movement and storage of goods, the trade related clearance and declaration of goods, the financial payment for the movement and purchase of the goods, and the information flows that accompany the entire operation of international goods transport, constitute the broad operational components of the domain.

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Figure 10: Common international transport and logistics activities

Other complexities arise when additional services are performed, intermediate storage is required, or when direct to customer delivery is specified. However, for a simple introduction to the process of international shipment this overview should suffice. In the following sections of the report information on primary stakeholders, the various performance measurement processes, contract processes, payment and ownership transfer categories and other pertinent information necessary to obtain an overview and understanding of the domain is presented. Further information on the terms used in the domain and the topics discussed in the following sections can be obtained by going to the FInest domain dictionary.

2.5.1. Stakeholders

The origin of each shipment is a sales or purchasing agreement between two parties. Generally these parties are called the shipper (seller) and consignee (receiver). Their agreement about exchanging goods against payments initiates the process of how the goods will be moved by whom, when and to which place under which conditions.

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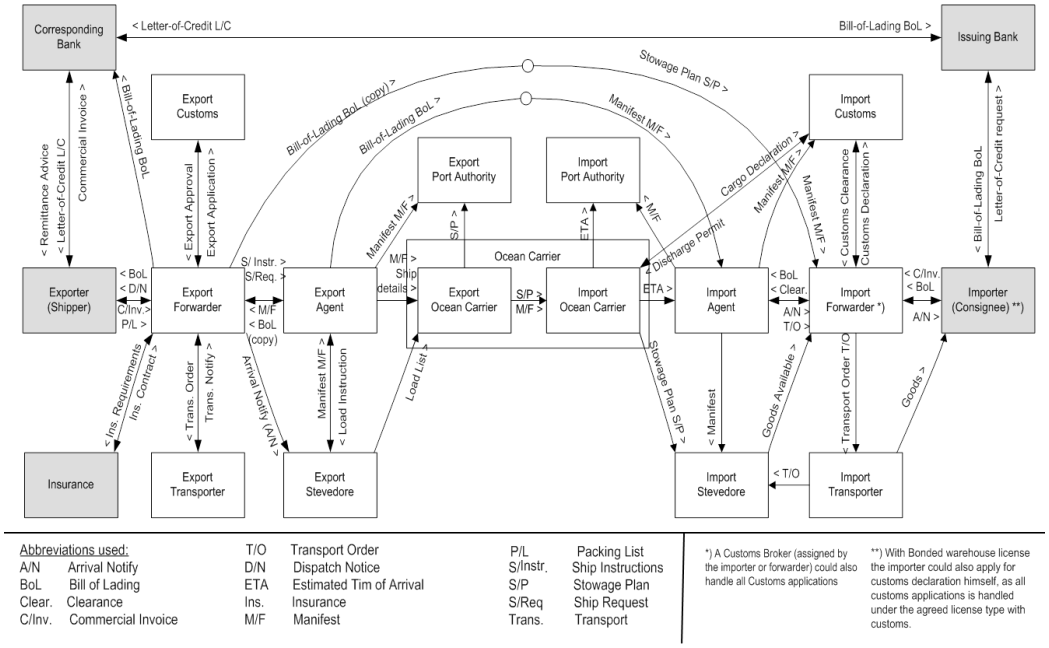

Figure 11: IBM and KN Secure Trade Lanes Project

The chart above is a simplified picture of the complex relations between all the parties who might be involved in a single commercial activity. Apart from shipper and customer, who actively participate in the initiation event, all other parties participate as service providers or sub contactors of service providers in the execution of the shipment. The roles of the service providers are not static in the process. A service provider may take on several roles as the shipment progresses through the supply chain. The transition between roles will depend on the capabilities of the service provider as well as the contracted services requested by the shipper.

2.5.1.1. Shipper (Seller)

The shipper and the consignee initiate the supply chain process when agreeing on a sales or purchase contract. A shipper can also be called a consignor. The purchase contract will contain clauses concerning the delivery terms of the shipment. A global standard in commercial delivery terms are the Incoterms. These delivery terms clarify responsibilities, cost and liability among the partners. [GCS 2010]

The shipper is responsible for providing the cargo at the origin of the process. Depending on the delivery terms, the shipper might involve other parties in the execution of its tasks as sub-contractors. The shipper is also responsible for providing certain documents pertaining to the goods being shipped, e.g., letter of origin, load list containing weights and dimensions for the goods, and export approvals if necessary. Additional documents that the shipper might have to provide include a certificate from an approved certification company that the shipment

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matches the items described in the sales contract and on the load list. This certification is mandatory if a bank has issued a credit letter for the shipment.

To address risks of loss or damage during the shipping process the shipper might contract with an insurance broker to cover the risks of the transport. Without such coverage the various execution entities involved in the shipment of the shipper's goods are limited in the damages that they must pay in case of loss by international conventions.

Because of all of the issues associated with moving goods internationally, most shippers will likely outsource most of the shipment tasks to an experienced international freight forwarder. The freight forwarder will then manage documentation and sub-contracting tasks on behalf of the shipper.

2.5.1.2. Consignee (Buyer)

The consignee is the final receiver of the cargo. The consignee's tasks and activities are very similar to those of the shipper. As the partner of the shipper in the sales / purchase contract the consignee's responsibilities, costs and liabilities are defined in the delivery terms agreed to. While the consignee does not have to provide any transport documentation for the shipment, they may have to provide a credit letter before the shipment can be released by the shipper [GCS 2010]

2.5.1.3. Carrier (land, rail, sea, air)

Carriers are steam ship companies, airlines, railway companies and trucking companies. The carrier performs the physical transport tasks in the shipping process. Most carriers own their own transport equipment. Some carriers, however, act as non-vehicle operating entities, which means that they perform all functions of an asset owning carrier, but are free to contract with any third party who owns assets for actual carriage of the goods. Non-vehicle operating entities must obtain special certification and authorization from local authorities to operate in this manner.

Within the shipping industry a special document exists that is used to describe the contents of a shipment. This document is called the bill of lading. Modern bills of lading are descriptive documents that are used primarily as inventory documents indicating the amount of each type of good shipped in the particular container. The container can be an ocean freight container, an airline ULD, a rail car, or a truck trailer. The bill of lading used in this manner has cross modal general applicability.

There exists another, more ancient and historical, bill of lading that can be used that acts as a negotiable document that indicates that the holder of the bill of lading is also the owner of the

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goods shown on the bill of lading. This document is seldom used today as other mechanisms have developed to show ownership and manage ownership transfer.

2.5.1.4. Freight Forwarder

Freight forwarders are transport intermediaries that offer a wide range of services to shippers. Freight forwarders typically arrange cargo movement to an international destination. Also referred to as international freight forwarders, they have the expertise that allows them to prepare and process the documentation and perform related activities pertaining to international shipments. Some of the typical information reviewed by a freight forwarder is the commercial invoice, shipper's export declaration, bill of lading and other documents required by the carrier or country of export, import, or transshipment.

Freight forwarders can be generalists or specialize in a particular niche of transport or on particular types of products. Global forwarders have built up international networks of company owned branches while local players collaborate with partners who operate at the destination of the goods being shipped.

A special legal classification has been developed for certain types of freight forwards. This classification, NVOCC (non-vessel operating common carrier), allows a freight forwarder that does not own its own transport vehicles to act as if it did. The NVOCC forwarder can issue bills of lading in the name of its virtual shipping company, assign space on “virtual” transport vessels and perform other activities as if it truly owned transport vessels. This classification has allowed freight forwarders to compete more evenly with steam ship companies for customers while providing customers with a more complete end-to-end shipping service than a traditional steamship company can provide.

The liability of a freight forwarder for the goods they are responsible for shipping is very limited. Standard terms and conditions have been developed that cover most freight forwarding activities. These terms and conditions are assumed to apply to any contract the forwarder signs unless other contractual terms are mutually agreed upon. The terms and conditions of freight forwarders are usually embodied in national rules in regulations. In Germany, for instance, freight forwarding terms and conditions are regulated and established by the Allgemeine Deutsche Spediteurbedingungen (ADSp). Because of the limited liabilities embedded in national regulations such as the ADSp most freight forwarders offer insurance to cover the risks associated with the international shipment of goods. In some countries this additional insurance is mandatory and shippers must insure their shipments.

2.5.1.5. Customs

Customs authorities are public servants authorized by the country they represent to check cargo that is presented to them against the documentation that the shipper or forwarder has

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provided in their customs declaration. The term “customs authority” can cover a number of entities that oversee the inspection of goods for export and import. Individuals may be called customs officials, agriculture inspectors, security inspectors, etc. All of these entities are covered by the broad term “customs authority.”

Customs authorities check goods for compliance with customs documentation, whether the goods comply with export or import laws and any other regulation (e.g., embargoes, copyrights, etc.). Should a legal issue or documentation discrepancy be observed, the customs authorities have the right to hold the goods until clarification, document correction or other action is taken by the shipment owner to clear up the issue. Customs authorities, as legal representatives of their governments, can collect duties, taxes and other fees on behalf of that government.

Goods to be exported must be announced proactively to the customs authorities by the exporter. A freight forwarder can do this task on behalf of the shipper if such an entity has been contracted to handle the shipping process. On-line customs applications are available for registered organizations in some countries. In countries such as the United States, only certain organizations that have been certified according to country specific criteria as authorized economic operators can perform online declarations.

2.5.1.6. Insurance Brokers / Companies

Insurance brokers act as intermediaries between insurance companies offering various types of marine, transport, storage and other insurance contracts and shippers. Insurance brokerage is an important part of the transport and logistics process as standard transport and storage terms and conditions are generally insufficient to provide a shipper with proper coverage for loss or damage of goods that are in transit or storage.

2.5.2. Contracting

When a shipper and a consignee decide to do business with one another they do so based on contracts. Contracts also are established between the various intermediaries and agents that act on behalf of either the shipper or the consignee.

Contracts are legally enforceable documents that stipulate the terms and conditions of a sale or purchase. Contracts can specify penalties and bonus malus payment schemes as well. When such mechanisms are stipulated in a contract service level requirements and/or key performance indicators are also stated. The inclusion of such terms have become very common in contracts, particularly contracts between large shippers and their logistics service providers.

Enforceable contracts must stipulate a legal jurisdiction upon which they are based. This jurisdiction may be the country in which the shipment originates, the destination country or

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another country where the contracting parties have a legal presence. This legal jurisdiction is not only where the terms and conditions must be judged, but it is also the location where any disputes between the contracting parties must to adjudicated. Many times the jurisdiction is selected based on how "friendly" it is to one party or the other.

While the development of contracts between parties involved in international freight movements is both a requirement and a common activity, managing the actual execution of the freight movements according to the stipulations in a contract is not easy. Some examples of problems that arise in managing shipments to contracts are:

- Actual volumes carried versus contractual volume commitments;
- Global conformance versus local exceptions;
- Integration of disparate information systems from partners to monitor service levels and key performance measures;
- Contractually required reporting versus operationally necessary reporting;
- Matching of invoiced services against actually delivered services;
- Anticipated costs versus actual incurred costs;
- Maintenance of up to date contact and escalation processes.

All of these challenges have a negative impact on operational costs, working capital requirements and revenue.

2.5.2.1. General Agreements

General agreements are long term or open contracts made between parties that have decided to work together in a common manner across all services and geographies. The general agreement defines a framework of terms and conditions for covered activities between the parties. Particular services to be provided, and that are subject to the "frame agreement", are placed in appendices and attached to the general agreement. The general agreement's terms and conditions become the governing terms and conditions for all such added services.

2.5.2.2. Volume based contracts

Agreements can be made based on volumes/capacity. Such contracts stipulate that a shipper will deliver to a carrier a certain amount of cargo (TEUs, tonnes, boxes, etc.), in a certain period of time, under conditions specified in the contract. These contracts are used when a shipper knows that they need to ship a defined amount of cargo in a certain time period, but they do not know the exact dates that these shipments will be executed. By contracting with a carrier on a volume basis the shipper is able to secure capacity that must be made available when the shipment dates actually become known.

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2.5.2.3. Tariff based contracts

Tariff based contracts stipulate a tariff or rate for shipping a particular good over a particular lane. The rate for the shipment is stipulated based on lane (origination point to destination point) and volume/weight shipped. These types of contracts do not require the shipper to use the carrier who has signed the tariff contract. If the shipper does decide to use the carrier who has signed the contract, then the rates stipulated apply. The shipper, however, can use any carrier for the shipment and in that case the tariff based contract serves simply as a market price comparison chart. This type of contract is usually time limited and the rates are renegotiated at periodic intervals.

2.5.2.4. Blanket contracts

Blanket contracts are similar to general agreements. However, a blanket contract is limited in its scope to only those products or services stipulated in the contract, even though this stipulation may be quite broad. Blanket contracts do not usually include the option of adding appendices for inclusion of additional items to be covered by the contract. For such requirements a general agreement type of contract is more commonly use.

2.5.2.5. Spot market agreements

Contracts made for short term or one time services are generally made on the spot market. Such contracts are usually negotiated quickly and, therefore, standard terms and conditions of the shipper are generally used. These types of contracts are common for local transport of goods. Because of the ad hoc nature of these types of contracts, the contracting process is usually manual with contracts being negotiated over the telephone and confirmed via fax or email.

2.5.3. Service Level Agreements (SLA)

A service level agreement is a part of a service contract where the level of service is formally defined. A service level agreement is normally a negotiated agreement between two parties wherein one is the customer and the other is the service provider. This can be a legally binding formal or informal "contract". Contracts between the service provider and other third parties are often (incorrectly) called SLAs — because the level of service has been set by the (principal) customer, there can be no "agreement" between third parties; these agreements are simply a "contract." Operating Level Agreements or OLAs, however, may be used by internal groups to support SLAs.

The SLA records a common understanding about services, priorities, responsibilities, guarantees, and warranties. Each area of service scope should have the "level of service"

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defined. The SLA may specify the levels of availability, serviceability, performance, operation, or other attributes of the service, such as billing. The "level of service" can also be specified as "target" and "minimum," which allows customers to be informed of what to expect (the minimum), while providing a measurable (average) target value that shows the level of performance. In some contracts, penalties may be agreed upon in the case of non-compliance of the SLA. It is important to note that the "agreement" relates to the services the customer receives, and not how the service provider delivers that service.

Service level agreements are, by their nature, "output" based — the result of the service as received by the customer is the subject of the "agreement." The (expert) service provider can demonstrate their value by organizing themselves with ingenuity, capability, and knowledge to deliver the service required, perhaps in an innovative way. Organizations can also specify the way the service is to be delivered, through a specification (a service level specification) and using subordinate "objectives" other than those related to the level of service. This type of agreement is known as an "input" SLA.

2.5.3.1. Service level agreements at different levels

Service level agreements can be defined to cover different types and levels of services to customers. Some common examples of differently focused service level agreements are:

- **Customer-Based SLA**: An agreement with an individual customer group covering all the services they use. For example, an SLA between a supplier (warehousing service provider) and the merchandising department of a large retailing company for services such as fill rates, delivery timing, invoice accuracy, inventory accuracy, etc.;
- **Service-Based SLA**: An agreement for all customers using the services being delivered by the service provider;
- **Multilevel SLA**: The SLA is split into the different levels, each addressing a different set of customers for the same services, in the same SLA;
- **Corporate Level SLA**: Covering all the generic service level management (often abbreviated as SLM) issues appropriate to every customer throughout an organization;
- **Customer Level SLA**: Covering all SLM issues relevant to a particular customer group, regardless of the services being used;
- **Service Level SLA**: Covering all SLM issue relevant to specific services in relation to a specific customer group.

2.5.4. Key Performance Indicators

A performance Indicator or Key Performance Indicator (KPI) is a term used for a type of measure of performance. KPIs are commonly used by an organization to evaluate its success or the success of a particular activity in which it is engaged. Sometimes success is defined in terms of making progress toward strategic goals, but often success is simply the repeated

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achievement of some level of operational goal (zero defects, 10/10 customer satisfaction etc.). Accordingly, choosing the right KPIs is dependent upon having a good understanding of what is important to the organization. 'What is important' often depends on the group measuring the performance - the KPIs useful to a finance team will be quite different to the KPIs assigned to the supply chain team, for example. Because of the need to develop a good understanding of what is important, performance indicator selection is often closely associated with the use of various techniques to assess the present state of the business and its key activities.

Indicators identifiable as possible candidates for KPIs can be summarized into the following sub-categories:

- Quantitative indicators which can be presented as a number;
- Practical indicators that interface with existing company processes;
- Directional indicators specifying whether an organization is getting better or not;
- Actionable indicators that are sufficiently in an organization's control to effect change;
- Financial indicators used in performance measurement and when looking at an operating index.

Key Performance Indicators, in practical terms and for strategic development, are objectives to be targeted that will add the most value to a business.

2.5.4.1. KPIs in Transport and Logistics

Businesses can utilize KPIs to establish and monitor progress toward a variety of goals, including lean manufacturing objectives, MBE (Minority Business Enterprise) and diversity spending, environmental "green" initiatives, cost avoidance (CA) programs and low-cost country sourcing (LCCS) targets.

Within transportation and logistics operation, some typical areas that are measured using KPIs are:

- sales forecasts
- inventory levels and turns
- procurement and supplier performance
- warehousing costs and fill rates
- transportation costs and delivery performance
- reverse logistics costs

2.6. Incoterms

Incoterms are international agreements on for the international transport of goods. The first Incoterms date back to as early as 1932. Incoterms are formulated and published by the

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International Chamber of Commerce. Incoterms are updated periodically by the Chamber based on the changing nature of international transport operations. The latest update to the Incoterms occurred in 2010 when the older 2000 version was simplified.
The English text version of the Incoterms is the original and official version of the Incoterms. This version of the Incoterms has been adopted by the United Nations Commission on International Trade Law (UNCITRAL). Certified translations in multiple languages are available from the national Chambers of Commerce.

Figure 12 following shows, in a simplified manner, how tasks and responsibilities are split between consignee and consignor (buyer and seller) in an international trading activity. The different Incoterms are explained in greater detail in the section that follows this figure.

	Incoterms 2010 Rules Chart of Responsibility												
	Incoterms 2010 / Charges/Fees		Packaging	Loading Charges	Delivery to Port/ Place	Origin Export Duty & Taxes	Origin Terminal Charges	Loading on Carriage	Carriage Charges	Insurance	Destination Terminal Charges	Delivery to Destination	Import Duty & Taxes
Any Transport Mode	EXW	Ex Works	Buyer or Seller	Buyer	Buyer	Buyer	Buyer	Buyer	Buyer		Buyer	Buyer	Buyer
	FCA	Free Carrier	Seller	Seller	Seller	Seller	Buyer	Buyer	Buyer		Buyer	Buyer	Buyer
Sea/Inland Waterway Transport	FAS	Free Alongside Ship	Seller	Seller	Seller	Seller	Seller	Buyer	Buyer		Buyer	Buyer	Buyer
	FOB	Free on Board	Seller	Seller	Seller	Seller	Seller	Seller	Buyer		Buyer	Buyer	Buyer
	CFR	Cost & Freight	Seller	Seller	Seller	Seller	Seller	Seller	Seller		Buyer	Buyer	Buyer
	CIF	Cost Insurance & Freight	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Buyer	Buyer	Buyer
Any Transport Mode	CPT	Carriage Paid to	Seller	Seller	Seller	Seller	Seller	Seller	Seller		Seller	Buyer	Buyer
	CIP	Carriage Insurance Paid to	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Seller	Buyer	Buyer
	DAT	Delivered at Terminal	Seller	Seller	Seller	Seller	Seller	Seller	Seller		Seller	Buyer	Buyer
	DAP	Delivered at Place	Seller	Seller	Seller	Seller	Seller	Seller	Seller		Seller	Seller	Buyer
	DDP	Delivered Duty Paid	Seller	Seller	Seller	Seller	Seller	Seller	Seller		Seller	Seller	Seller

Figure 4: Incoterms 2010 – Rules and responsibilities (Source: Universität Duisburg-Essen)

2.6.1. The Incoterms in detail

EXW (Ex Works) — The buyer bears all costs and risks involved in taking the goods from the seller's premises to the desired destination. The seller's obligation is to make the goods available at its premises (works, factory, warehouse). This term represents the minimum obligation for the seller and maximum obligation for the buyer. This Incoterm can be used for all modes of transport.

FCA (Free Carrier) — The seller's obligation is to hand over the goods, cleared for export, into the charge of the carrier named by the buyer at the named place or point. If no precise point is indicated by the buyer, the seller may choose within the place or range stipulated where the carrier shall take the goods into its charge. When the seller's assistance is required in making the contract with the carrier the seller may act at the buyers risk and expense. This Incoterm can be used for all modes of transport.

CPT (Carriage Paid — The seller pays the freight for the carriage of goods to the named destination. The risk of loss or damage to the goods occurring after the

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To)	delivery has been made to the carrier is transferred from the seller to the buyer. This term requires the seller to clear the goods for export. This Incoterm can be used for all modes of transport.
CIP (Carriage & insurance Paid to)	The seller has the same obligations as under CPT but has the responsibility of obtaining insurance against the buyer's risk of loss or damage of goods during the carriage. The seller is required to clear the goods for export. The seller is only required to obtain insurance for the minimum coverage of the goods being shipped. This term requires the seller to clear the goods for export. This Incoterm can be used for all modes of transport.
DAT (Delivered At Terminal)	Seller delivers when the goods, once unloaded from the arriving means of transport, are placed at the disposal of the buyer at a named terminal at the named port or place of destination. "Terminal" includes quay, warehouse, container yard or road, rail or air terminal. Both parties should agree to the terminal and, if possible, a point within the terminal at which point the risks will transfer from the seller to the buyer of the goods. If it is intended that the seller is to bear all the costs and responsibilities from the terminal to another point, DAP or DDP may apply. This Incoterm can be used for all modes of transport.
DAP (Delivered At Place)	Seller delivers the goods when they are placed at the disposal of the buyer on the arriving means of transport ready for unloading at the named place of destination. Parties are advised to specify as clearly as possible the point within the agreed place of destination, because risks transfer at this point from seller to buyer. If the seller is responsible for clearing the goods, paying duties etc., consideration should be given to using the DDP term. This Incoterm can be used for all modes of transport.
DDP (Delivered Duty Paid)	The seller is responsible for delivering the goods to the named place in the country of importation, including all costs and risks in bringing the goods to the import destination. This includes duties, taxes and customs formalities. This Incoterm can be used for all modes of transport.
FAS (Free Alongside Ship - named port of shipment)	The seller must place the goods alongside the ship at the named port. The seller must clear the goods for export. This Incoterm is suitable only for maritime transport but not for multimodal sea transport in containers (see Incoterms 2010, ICC publication 715). This term is typically used for heavy-lift or bulk cargo.
FOB (Free On Board - named port of shipment)	The seller must load themselves the goods on board the vessel nominated by the buyer. Cost and risk are divided when the goods are actually on board the vessel. The seller must clear the goods for export. The term is applicable for maritime and inland waterway transport only, but not for multimodal sea transport in containers (see Incoterms 2010, ICC publication 715). The buyer must instruct the seller on the details of the vessel and the port where the goods are to be loaded, and there is no reference to, or provision for, the use of a carrier or forwarder.
CFR (Cost and	The seller must pay the costs and freight required in bringing the goods to the named port of destination. The risk of loss or damage is transferred

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FReight)	from seller to buyer when the goods pass over the ship's rail in the port of shipment. The seller is required to clear the goods for export. This term should only be used for sea or inland waterway transport.
CIF (Cost, Insurance & Freight)	The seller has the same obligations as under CFR however it is also required to provide insurance against the buyer's risk of loss or damage to the goods during transit. The seller is required to clear the goods for export. This term should only be used for sea or inland waterway transport.

2.7. Trade Payment Methods

The exchange of goods for money is the origin of trade. Seller and consignee have to agree on a process that covers the risks of doing business with partners in different countries with different legislations. Today there are certain different payments terms in use to fulfill the requirements of both parties (Kummer et al., 2009).

2.7.1. Cash in Advance

The Cash in Advance or Advance Payment method allows the buyer to pay cash in advance to the seller. Paying in advance gives the greatest protection for the seller and puts the risk on the buyer. Payment does not guarantee the shipment or delivery of the goods from the seller. Therefore, the buyer will rarely pay cash up front before receiving an assurance that the goods will be shipped and that the quality and quantity of the goods ordered will be delivered.

2.7.2. Open Account

An open account transaction means that the goods are manufactured and delivered before payment is necessary (for example, payment could be due 14, 30, or 60 following shipment or delivery). The method provides great flexibility and in many countries sales are likely to be made on an open-account basis if the manufacturer has been dealing with the buyer over a long period of time and has established a secure working relationship.

The open account method is a preferred method of payment for the importer, since it places the risk on the exporter or seller. This method cannot be used safely unless the buyer is credit worthy and the country of destination is politically and economically stable. However, in certain instances it might be possible to discount open accounts receivable with a factoring company or other financial institution.

2.7.3. On Consignment

With consignment sales, the seller does not receive payment until the importer sells or resells the goods. The product stays with the importer until all the terms of the sale have been satisfied. In the consignment method, the importer is called the consignee and is responsible for paying for the goods when they are sold. Consignment sales are very risky and there is no

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control available to the exporter. Obtaining sales proceeds or return of the merchandise if it is not sold can be difficult.

2.7.4. Draft or Documentary Collection

The Draft or Documentary Collection method is employed when either the cash in advance method is not acceptable to the buyer, or the open account method is not acceptable to the seller. With the Draft or Documentary Collection method, the seller or exporter ships the goods and draws a draft or bill of exchange on the buyer or importer through an intermediary bank. The draft is an unconditional order to make a payment in accordance with certain terms. The documents needed are specified before the title for the goods is transferred.

There are four parties involved in the documentary collection method:

1. The buyer,
2. collecting/presenting bank (buyer's bank),
3. the seller, and
4. the remitting bank (seller's bank).

There are also four main steps in the documentary collection method.

1. The seller sends the draft to the remitting bank;
2. The remitting bank, as an intermediary, sends the draft to the collecting/presenting bank;
3. The collection/presenting bank, as an intermediary, makes the documents available to the buyer;
4. The buyer, after examine the documents, has three options:
    - to pay immediately
    - to pay at a future date
    - to refuse to pay for the draft

When the draft is paid, the title documents are released to the buyer so they can obtain possession of the goods. As the title to the goods is not transferred until the draft is paid or accepted, both the buyer and seller are protected. However, nothing prevents the buyer from refusing a draft for payment.

In such cases, the exporter, who has already shipped the goods, faces the problem of getting its merchandise back, which may involve warehousing or insuring the goods, or even disposing of the merchandise at the collection point. If the buyer refuses or defaults on payment of the draft, the seller may also have to pursue collection through the courts (or possibly, by arbitration, if such had been agreed upon between the parties). The use of drafts involves a certain level of risk; but they are less expensive for the purchaser than letters of credit.

2.7.4.1. Sight Drafts

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If the exporter and importer have agreed that payment should be made immediately upon receipt of the draft and/or shipping documents by the buyer's bank, the draft is said to be drawn at sight. A sight draft is an order signed by the seller instructing the buyer to pay a specified amount to the seller upon presentation of the draft.

2.7.4.2. Time Drafts

If the seller has provided credit terms to the buyer, thereby allowing the merchandise to be released before payment is received; it is called a time draft. The exporter will need a written promise from the buyer that payment will be made at a specified future date. When a bank receives time drafts, the bank is requested to deliver the documents only when the buyer has accepted. The buyer's acceptance of the draft is his/her agreement to pay at an agreed upon future date.

2.7.5. Letter of Credit

The Letter of Credit has been a key means of payment in international trade for many years. It continues to play an important role in world trade today. A simple reason for its use is that the seller will not usually ship without a bank's assurance of payment. While this is a major factor in its continued use, the Letter of Credit offers other advantages for the buyer and seller.

Both buyers and sellers profit from the distinct uniqueness of a Letter of Credit. However, both parties must be aware of what a Letter of Credit does not do (Kummer et al., 2009):

- It does not provide a total assurance of payment to anyone. A Letter of Credit guarantees payment only if its terms and conditions are satisfied by presenting the necessary documents.
- The value of such a guarantee depends upon the stability of the bank providing its undertaking and the political and foreign exchange stability of the country where the bank is situated.
- It does not give a guarantee that the goods depicted in the presentation documents have been delivered. Banks don’t deal with goods and services; they deal with documents related to the Letter of Credit. The quantity and quality of the goods shipped depends upon the honesty and integrity of the seller that has manufactured or packaged the goods and organized the delivery.

The buyer may stipulate that the Letter of Credit be accompanied by laboratory test certificates, inspection certificates or other documents that confirm the quality or quantity of the goods. Generally, the buyer and seller agree in advance on which party is responsible for the sum of these services.

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2.8. Industry ICT Initiatives

Currently, no commercial industry ICT initiative can provide a complete end-to-end solution for setting up and managing an international supply chain. However, there exist some industry initiatives that attempt to address the needs of specific links within the supply chain. These initiatives focus on particular modes of transport and primarily attempt to provide either track and trace services or limited contracting services. The two most successful of these current efforts are described below.

2.8.1. Cargo 2000

Cargo 2000 (C2K) is an airfreight management system developed jointly by industry and the International Air Transport Association (IATA). C2K defines specific performance metrics for the transportation of goods by air transport. C2K specifies how performance data is to be collected and provides information standards for the integration of these data into company performance measurement, monitoring and reporting systems.

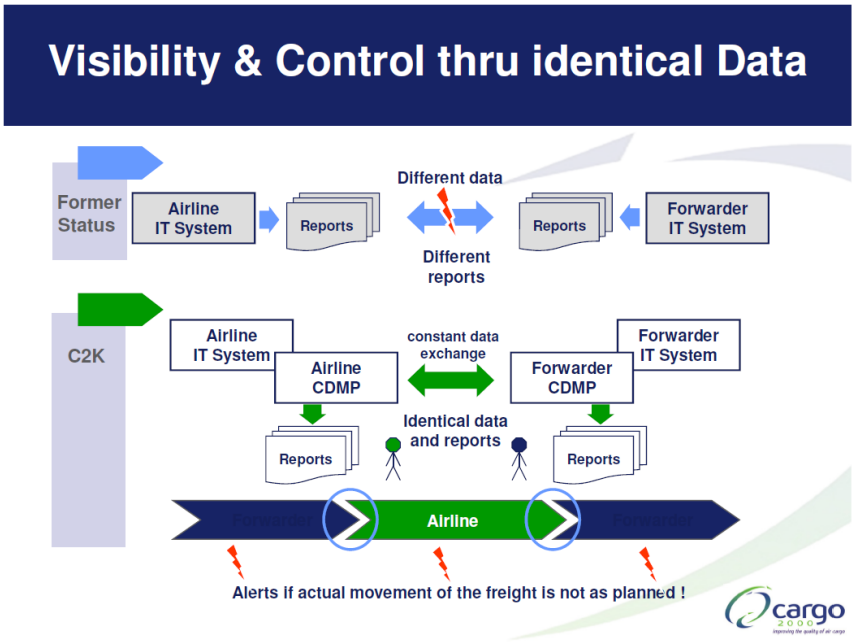

Figure 13: Cargo 2000 – Visibility & Control thru identical data (Source: Cargo 2000)

The key benefit of the Cargo 2000 standard is the visibility to actual shipment statuses that the system provides. Companies that have implemented Cargo 200 are able to see where their goods are at any time during the shipment process. As Figure 14 following indicates, Cargo 2000 accomplishes this by allowing companies to observe where a shipment is in near real time and use this information to forward plan their downstream operations. This integrated process, although not fully implemented by partners, has the potential of streamlining

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planning and re-planning activities while enhancing customer responsiveness to unplanned shipment delays.

Cargo 2000: Visibility & Monitoring, Planning & Execution

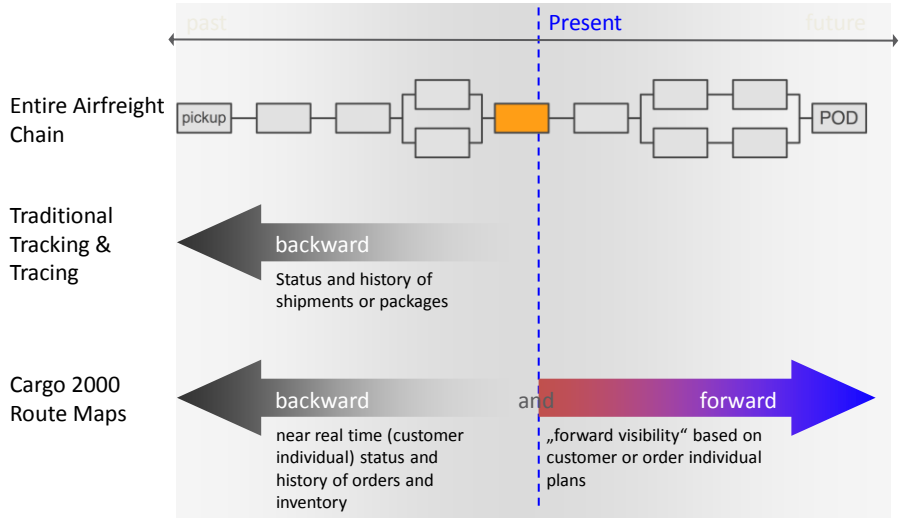

Figure 5: Cargo 2000 – Visibility & Monitoring, Planning & Execution (Source: Cargo 2000)

According to IATA, the main objectives of Cargo 2000 are (IATA, Cargo 2000)

- Achieving transparency and visibility of the actual freight movement for the customer by applying C2K measurement of milestones and alert setting procedures during transportation;
- Improving internal processes to enhance service delivery by using the C2K milestone measurement and alert system as well as applying the C2K Quality Management System;
- Achieving recognition of adherence to C2K quality standards through structured auditing procedure and certification;
- Comprehensive reporting on compliance with harmonized C2K standards/milestones and selected KPI's including benchmarking of performances within the industry;
- Gaining experience from knowledge and best practices of the C2K member organization in finding solutions for existing and future challenges to improve transportation performance;
- Getting access to comprehensive documentation of proven procedures and specifications of C2K processes and quality standards to measure and benchmark supply chain performance;
- Supporting and facilitating the alignment with new developments in the industry by harmonizing standards, procedures and business rules within C2K.

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The plan for achieving these objectives through the development and deployment of the Cargo 2000 standard is split into three distinct phases. The first phase of implementation involves organizations integrating their internal track and trace systems with airline information systems to obtain airport-to-airport tracking of goods. The second phase of implementation involves the integration of inbound transport operations and outbound delivery operations with the airport-to-airport tracking activities. This allows phase two partners to gain door-to-door visibility of their shipments. The final phase of implementation increases the granularity of the tracking process so that individual items can be tracked through the entire shipment process. Implementation of this final phase will provide shipping companies and shippers the ability to not only track goods through the supply chain, but pro-actively plan and verify their delivery.

Cargo 2000 - Three phases

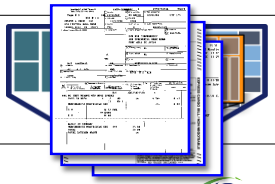
	Chain definition	Monitoring level	Visual Representation
1	Airport to Airport (A2A)	Master AWB level Shipment planning & tracking	
2	Door to Door (D2D)	House AWB level; Shipment planning & tracking (Example of 3 HAWB)	
3	Door to Door (D2D)	Shipment planning & tracking at piece level with document tracking	

Figure 15: The three phases of Cargo 2000 (Source: Cargo 2000)

2.8.2. INTTRA

INTTRA is a sea freight management system. It was established to provide major shippers with their own shipping line/carrier contracts an opportunity to engage in sea freight coordination services and to obtain access to highly configurable customer information solutions for sea freight visibility, monitoring, reporting and network management. The INTTRA marketplace allows shippers to book space online against carrier contracts that they have established with participating steamship companies. This capability provides the shippers with more accurate capacity consumption information and simplifies the booking process for shipping goods via container ship. The marketplace also assists steamship companies in managing their contracts with the shippers.

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INTTRA provides the shipper with a portal into available capacity on ships leaving particular ports and sailing to desired destinations on particular dates. The shipper can reserve space on steamships via the portal and debit existing accounts that they have with the steamship companies. Steamship companies can also advertise open capacity on vessels to better manage their fleets (Figure 16).

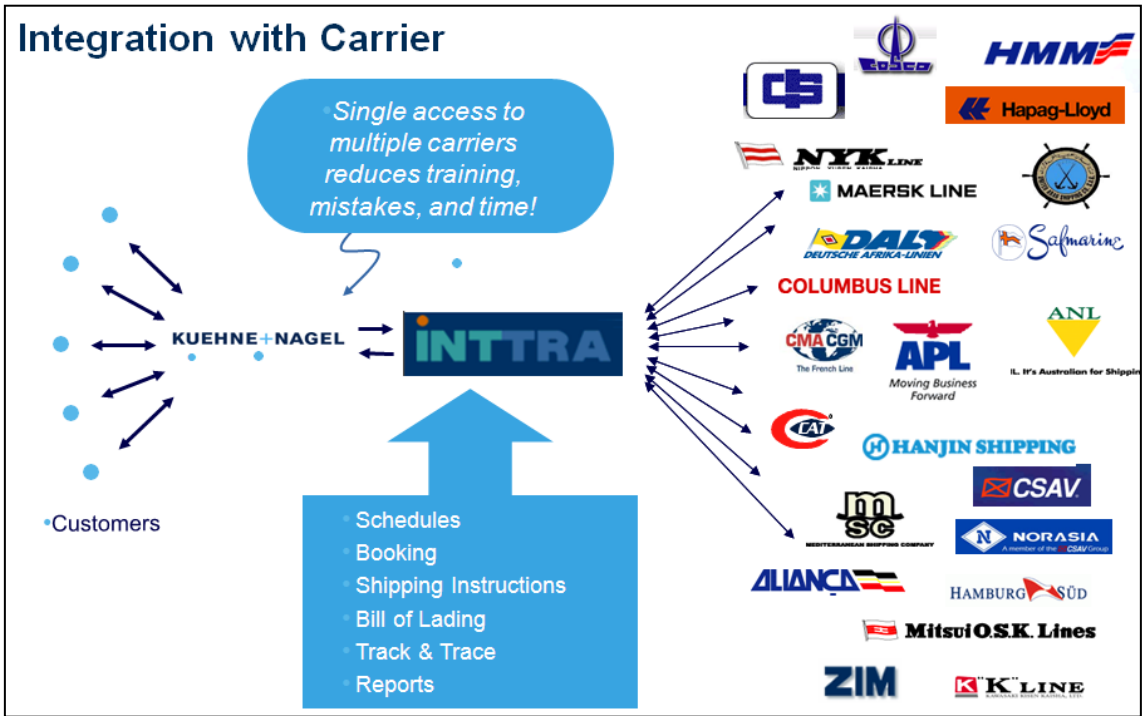

Figure 6: Inttra chart - displaying the relationships and information flow in the system (Source: Kühne & Nagel)

2.8.3. Freight Exchanges

Carriage of goods by trucks is a more spontaneous process than long haul freight across the ocean or through the air. Because of its spot market nature, a number of freight exchanges for trucking services have been implemented over the past decade. These systems provide a platform that allows carriers to communicate freight traffic information to fellow operators such as transporters, forwarders and logistics companies. They allow forwarders to advertise their freight requirements either privately or publicly to a large number of freight operators that are looking for loads. They also allow freight operators to offer vehicle space. These online systems are normally subscription-based with a small charge for advertising (posting) and searching (consulting).

Some examples of these types of exchanges are "CARGOTRANS"[1], which is the leading online European Union freight and vehicle exchange based on e-mail. "Trans-Aktuell3000"[2] and the

[1] http://www.cargotrans.net/
[2] http://www.aktuell3000.de/

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"Frachtbörse" of "Gewerbezentrale Spedition und Logistik"[3] are two German freight exchanges. These exchanges all share common characteristics of subscription services for posting capacity requirements, capacity availability, contract terms, service levels and contracting. In addition, services for grading performance are provided.

3. Next Steps

This document contains an initial outline of the complex domain known as the transport and logistics domain. It is not a finished study, but a limited first step in the development of a more detailed understanding of the domain. This fact is consistent with the cyclical design of the FInest project in which each six month period is employed to deepen the design and analysis efforts of the project. Detailed work will continue over the next six months to further refine and extend the domain model tentatively developed here, identify additional domain related issues that must be addressed by any potential Future Internet based service, and enhance the FInest team's understanding of the needs of domain partners.

Future work on developing a detailed understanding of the business requirements for future ICT in the domain (D1.3), analysis of the current ICT landscape for transport and logistics operations (D1.4), additions to the transport and logistics domain dictionary (D1.1) and enhancement of the domain model (D1.2) will continue over the next six months.

[3] http://www.deutsches-transportgewerbe.de/frachtboerse.html

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