

MASTER

An ontology for special cargo

gathering and structuring knowledge within the planning of the special cargo domain for a top down ontology

Kolkman, T.L.

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Eindhoven University of Technology

Industrial Engineering and Innovation Sciences

In partial fulfilment of the requirements for the degree of:

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Innovation Management

An Ontology for Special Cargo

Gathering and structuring knowledge within the planning of the
special cargo domain for a top down ontology

Author: T.L. Kolkman

Student number: 1277596

1st Supervisor: Dr. K. Zervanou

2nd Supervisor: Dr. Y. Zhang

Thesis Company: Validaide B.V.

Company Supervisor: E. De Jong

Eindhoven University of Technology

School of Industrial Engineering

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Abstract

The airfreight industry of shipping goods that require special handling in their transport is known to be lagging in terms of innovation. This industry, also known as special cargo, deals with non-transparent data and outdated technology, which in return results in great inefficiency. The LARA (Lane Analysis & Route Advisor) project was initiated to address and combat this issue. This research is part of this project and investigates data and knowledge about planning shipments of special cargo, in specific trade lanes and its carriers, stakeholders, options, and capabilities. This study investigated different technologies and methods to gather and structure the knowledge and reviews different knowledge structures. As a result, an ontology is created; a semantic vocabulary that structured knowledge and can be used as the base of semantic document retrieval or artificial intelligence applications. The ontology followed the UPON methodology, augmented with knowledge elicitation techniques to derive knowledge from experts and evaluation techniques to validate the ontology.

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Executive Summary

While innovation is becoming a competitive advantage in many industries, the airfreight industry is slow in catching up. The industry concerning cargo that requires special handling, also known as the special cargo industry, also suffers from this. Data is poor and non-transparent, and technology is outdated since it's more costly to innovate in logistics than outside of this segment (Busse, 2010; LARA Project, 2019). Due to the complexity of the special cargo industry, standardization of knowledge is hard and often avoided, as stakeholders can gain from the information asymmetry, stakeholders such as freight forwarders "an individual or a company that organizes and plans a shipment, getting cargo from a point of origin to a destination point" (Freightos, 2018). However, surely the competitive advantage of transparency and innovation is becoming evident, thus a project was initiated that aims to achieve a high level of transparency and efficiency. The objective of this project, the LARA project (Lane Analysis & Route Advisor) is to develop one or multiple software tools for an Artificial Intelligence (AI) based route advisor, which in return will result in significant cost-saving, new business opportunities and avoid CO₂ emissions. This research is part of the LARA project and aims to investigate data and knowledge about planning shipments with special handling needs, with specific trade lanes and its carriers, stakeholders, options, and capabilities. In short, it explores the alternatives of the choice set for the routing options. This was a critical first step into the digitalization of the sector.

The research question that guides this study is: "In which way should a knowledge structure be constructed in order to support the planning phase within the special handling cargo sector?". To answer the question, this dissertation discusses different knowledge research fields and knowledge structures, and reviews which of these fields and structures is most appropriate for the domain. Based on this discussion, this study then reviews different methodologies for constructing the chosen knowledge structure. As a result, an applicable and appropriate methodology was constructed for the domain and applied to the scope of the knowledge structure to get the relevant concepts and attributes. After that, these relevant concepts and attributes were implemented into a software program that was chosen after an analysis of different programs. Finally, this result was evaluated based on reviewed evaluation methods and adjusted accordingly.

Structuring of knowledge is the main objective of this dissertation, and there are different research fields in how to do so. Examples are Knowledge Engineering, data mining, Artificial

Intelligence (AI), and semantic technologies, all covering the collection or usability of knowledge. Knowledge engineering is one of the more mature fields and is the activity that purposefully abstracts parts of reality, to model it for a system, a Knowledge Base System or KBS (Schreiber et al., 2000). There are different approaches in how to construct a KBS, alongside different methods to acquire the knowledge to build a KBS. The semantic web is a semantic technology applied to the world wide web, allowing for computers and machines to be able to conduct automatic reasoning that is made possible through structured sets of information and inference rules. One component that embodies the semantic web is an ontology, “a formal, explicit specification of a shared conceptualization” (Studer et al., 1998), also known as a (semantic) knowledge structure. The major characteristics of ontologies are the relationships amongst terms, concepts and hierarchy and the depth that is allowed to each term (Asim et al., 2018), allowing for an accurate representation of reality. This also allows machines to make use of the world wide web without any interference of humans, as an ontology translates human concepts in machine-readable terms. There are different approaches in constructing an ontology, i.e. top-down and bottom-up.

Due to the nature of the domain, a top-down ontology construction is chosen, which primarily focuses on general concepts and relationships on an abstract level. Multiple methodologies are assessed in the aid of creating an ontology, and in the analysis, these methodologies are assessed based on their ontology life cycle, (dis)advantages, and coherence with the objective of this research. As the acquisition of knowledge is crucial for the construction of the ontology, different methods are also reviewed, and finally, different ontology editors and evaluation methods were assessed. Some examples of ontology methodology are Enterprise Ontology, TOVE, METHONTOLOGY, and the final chosen methodology: UPON, Unified Process for ONtology building, which is based on a software development process. Different examples of Knowledge Acquisition from experts, or Knowledge Elicitation tools, that were assessed are (un)structured interviews, protocol analysis, matrix-based techniques. Finally, the following techniques were chosen to be implemented into the methodology: (un)structured interviews including the teach-back method, laddering, and document analysis. In terms of editors, due to the pluggability, long threshold and customizability, as well as the study of Siricharoen (2018), the chosen ontology editor is Protégé. Finally, the evaluation of an ontology is crucial and can be done in four strategies (Hlomani & Stacey, 2014): Gold Standard, Application-based, Data-driven and User-based. Due to the lack of gold standard, (technical) application, and data, human assessment was the main reference point. The evaluation was split into two to maintain

objectivity, namely the assessment, where competence questions and principles were assessed and the evaluation which consisted of a manual annotation approach to 20 documents that were annotated by an expert. The result of the analysis of different methodologies and techniques is the augmented UPON methodology with knowledge elicitation and evaluation tools.

The UPON methodology consists of 5 workflows namely, requirements, analysis, design, implementation, and test workflow. In requirements, the objective is to identify the objectives of the ontology users, which consists of (i) determining the domain of interest and the scope, and (ii) defining the purpose, which results in the usage of knowledge elicitation techniques and an Ontology Requirement Specification document as well as an application lexicon. In analysis, different existing ontologies were assessed, and a UML use case diagram was constructed, alongside the application lexicon. In the design workflow, the OPAL methodology is applied to the concepts, as well as justification for these concepts. In this workflow, some concepts required a more thorough explanation, and this is implemented in this workflow. The implementation consists of implementing the lexicon and its attributes into Protégé and offers metrics and visualization in how the ontology looks. The final workflow is testing the ontology, and this is done based on the ‘assessment’ and ‘evaluation’ methods as discussed. Whilst every ontology differs in structure as each individual has different interpretations, the test workflow was vital to assess the compliance to the domain. One of the main hindrances was the lack of technical application, as well as ontology instances that transform a knowledge structure into a knowledge base. Also due to the top-down approach, certain specific attributes were not considered but were later on implemented.

The objective was to develop a knowledge representation of the special handling goods and services in the airfreight sector based on a designed methodology that will digitalize the determination of the choice set for airfreight forwarders by making data transparent and understandable to machines. This was based on the needs of the innovation deficient industry of special cargo. This objective was executed, and the final design is a top-down ontology that can function as a knowledge structure. For the continuation of this study as well as the LARA project, the ontology should be elaborated upon through enrichment and population of the ontology, as well as the construction of an application.

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1. Introduction

Innovation is accelerating and disrupting day-to-day lives as well as industries. Virtual Reality, Artificial Intelligence, Internet of Things, and other technologies are rising; innovating the education environment to the light bulb industry. Yet the logistics sector is stagnating and still uses technologies and procedures that are decades old (Van Der Biest, 2019; PWC, 2016; Wilding & Juriado, 2004; Wallenburg, 2009). Data is poor and nontransparent (LARA Project, 2019), and technology is outdated since it's more costly to innovate in logistics than outside of this segment (Busse, 2010). Nonetheless, the slow emergence of start-ups and investments by big airlines is increasing the level of innovation within the logistics industry (Van Der Biest, 2019). The industry is trying to catch up with start-ups like Matternet, last-mile delivery through drones (Transmetric Blog, 2019), or Assaia, a start-up in AI technology that wants to transform the way ground crews and airports operate (Transmetric Blog, 2019). These start-ups and enterprises like Maersk and AllCargo (Van Der Biest, 2019) are slowly but surely shifting from the old, traditional methods towards a digital revolution, resulting in a higher level of efficiency as well as transparency (PWC, 2016). The IATA (International Air Transport Association) also launched a biannual award for innovation within the air cargo industry advocating innovation within the industry.

1.1. Special Cargo

The special cargo is omitted in this innovation process, due to the complexity of transporting in this segment. Special cargo, or special freight, are the products and goods with special handling needs, such as temperature-sensitive pharmaceuticals, flowers and food products (LARA Project, 2019). The International Air Transport Association (IATA), for example, has a voluntary diploma in special cargo handling, which they argue contains the necessary knowledge to handle special cargo. This is due to the significant difference in terms of handling compared to general cargo. Medicine often needs to be in a temperature-controlled environment otherwise they will be damaged. Lithium batteries are considered dangerous goods and have guidelines on how many batteries are allowed in one plane. Live animals have restrictions e.g. animals that emit repugnant odors or, dogs that are a specific breed that is prone to heat strokes, are not allowed on certain airlines. But also high valued items like diamonds or gold require special safety and security measures to guarantee the safety of the products.

Essential actors in the industry of special cargo are airfreight forwarders. Airfreight forwarders are "an individual or a company that organizes and plans a shipment, getting cargo from a point

of origin to a destination point" (Freightos, 2018). In other words, they arrange transport of products and therefore have to have all the information concerning which routes goods can or cannot take due to guidelines, restrictions, and risks. These air freight forwarders play a big role in transporting special cargo, as air is often the fastest way to ship products. However, the air freight forwarding process is almost fully analog when planning a special cargo shipment. Forwarders themselves contact the airlines through phone or email contact, to gain information on specific cargo and their routes (LARA Project, 2019). However, routings, carriers and service combinations for shipments can be as many as thousands, and it's not viable for manual data collection to gather all this information. Not only is it not viable, but it's also time-consuming, which in return intervenes with the efficiency of the process. Thus, some routings or carriers are skipped, to maintain efficiency, yet this tampers with the possible selection of routings which in result could lead to lower-cost efficiency. Hence, the airfreight forwarders process should be improved with easily-attainable and transparent data. As Chao, Lirn & Shang (2013) found, one of the variables airfreight forwarders were least satisfied with, is the performance of airlines in terms of efficiency in the rate of special cargo and reasonably so. The air freight business, specifically the special cargo sector is due for innovation. However, it often is mentioned that embracing new paradigms and investing in progressive ideas is not for the airfreight business (Etim, 2017; Aircargo News, 2017), yet this doesn't fully suffice as the explanation why there is such a hesitance in innovating.

This lag compared to other industries has several reasons as this sector is complex. In the pharma airfreight industry specifically, there are conflicts concerning the standardization of knowledge of special air cargo handling, which results in higher risk and unclear expectations (Hoets, 2018), which then makes innovation a delicate matter. Moreover, the fragmentation of the air cargo industry also hinders the process of innovation (Lennane, 2017), as stakeholders have little to gain becoming the first mover, as it's a time-intensive and expensive process. Stakeholders depend on others to innovate and then adopt once the innovation is completed, saving them the strain of the process. In 2018, there was an interview with Ryan Petersen, the CEO of Flexport, a digital forwarder who secured \$1 Billion in funding (Flexport, 2019). He explains that before the digital disruption gained speed, there was an information asymmetry, a trade black box, that freight forwarders would use to their advantage, e.g. demand high prices. This black box made freight forwarders hesitant to innovate, since it was profitable to not do so. Furthermore, the industry is apprehensive in general, arguing that logistics is a mere process of moving goods from one place to another (Lennane, 2017). This, however, is not the case.

Specifically, in the industry of products with special handling needs, technologies such as data mining, IoT, and others can make the industry more efficient. But implementing these modernizations requires changes from the sector, e.g. transparency. The lack of transparency has been a reoccurring problem (Hoets, 2018; PWC, 2016), and needs to be tackled if the process is to be optimized. As mentioned by Aircargo News (2017), current technologies are thus far disruptive, that the airfreight industry has no choice but innovating.

1.2. Special Cargo Innovation Drivers

As mentioned before, Van Der Biest (2019) indicated that start-ups are popping up, as well as bigger players are now innovating, simply because they don't, another enterprise will grab the competitive advantage. Furthermore, there are three other players causing disruption besides start-ups and competitors according to a report of BCG (Boston Consultancy Group, 2018). Suppliers, integrators and customers are three other forces that pose a threat against traditional forwarders. The total of these 5 forces is trying to bypass the traditional companies. When applying Porter's Five Forces model (Porter, 1979), which is used to analyze the competition based on five forces, there are quite some similarities to be found. In terms of forces, firstly there is the threat of new entrants, which are the startups as well as customers who are paving their own path. Secondly, the bargaining power of buyers, which are the customers who want lower cost and higher efficiency. This is because in a heavily competitive industry, customer expectations change (Rambhatla, 2019), as they expect more visibility and lower costs. Thirdly, the bargaining power of suppliers which are the suppliers that digitalizing. Furthermore, there is the threat of substitutes, which are both the suppliers and the start-ups, creating a digital plant form to diverse from traditional forwarders. Lastly, there is rivalry amongst competitors, some of the big players are already innovating. Porter's Five Forces is used to analyze the industry, and when analyzing the airfreight forwarders business, it's time to innovate. It is not a matter of 'if' but a matter of 'when'.

Furthermore, in BCG's report (Boston Consultancy Group, 2018), it is mentioned that due to the fragmented nature of the sector no company dominates, thus innovating operations or customer experience processes an attractive opportunity for making a profit, despite the strain. This is also intercepted by venture capitalists, who are now investing billions into the airfreight business (Air Cargo World, 2016; Boston Consultancy Group, 2019). In another report by BCG (Boston Consultancy Group, 2016), they offered insights on the transport and logistics (T&L) market, stating that for a freight forwarder to be successful, it must automate as well as offer

high end-to-end service quality, supported by IT solutions. Furthermore, they argue that a company in the T&L sector must also possess advanced IT and digital capabilities to be successful in the future. To conclude, the reasons why the air freight industry, with in specific the special handling cargo products, need to innovate are abundant, thus it's high time to do so.

1.3. Special Cargo Innovations

As innovation is overdue, it leaves many opportunities to focus on. Innovation can be approached in many ways, such as autonomous vehicles or robotic warehouses. Technologies such as IoT, data analytics or digital platforms, fall under Industry 4.0. This concept surrounds the creation and integration of innovative ICT (information and communication technologies), IoT (Internet of Things), Cyber-Physical System, Enterprise Architecture and Enterprise Integration (Lu, 2017) and aims to revolutionize industries. It's also known as the 'smart industry'. This industry is built on information and knowledge. For optimal use, these technologies need specific and accurate knowledge. To get this knowledge, the industry needs to be more transparent, which the lack thereof in the special cargo industry is a reoccurring problem (Hoets, 2018; PWC, 2016). Transparency is becoming a competitive advantage, as it allows companies to reach customers easier and innovate quickly as well as more efficient, partly due to the openness that allows a thorough insight into the customers' wishes (Zakutniaia & Hayriyan, 2017). Many types of innovations could aid the process of making knowledge transparent and available. These innovations can be used for several purposes but all focus on identifying and capturing meaningful knowledge to an organization, from different sources e.g. experts. This knowledge then needs to be represented and stored effectively so that this knowledge can be used in computer systems that will provide a competitive advantage for an organization (Milton, 2007). Knowledge engineering, knowledge-based engineering, semantic web, data mining, natural language processing, and ontologies can be considered prominent within the knowledge innovation field. As mentioned, knowledge is often non-transparent, yet it remains valuable, thus the special cargo industry could likely profit from innovation in terms of knowledge.

1.4. Introduction Case Company

In 2016, a software company called Validaide was founded. It aims to innovate and standardize supplier qualifications and lane risk assessments within the logistics industry, focusing on products with special handling needs, and in specific on pharma. Located in Amsterdam, Validaide intends to make the inefficient and non-transparent airfreight forwarding business visible, transparent and timesaving through collecting, managing and sharing supplier qualifications and risk assessments. In June 2017, the project DARA (Data Analytics for Trade Lane Risk Assessments and Control) was started to research the optimization of trade lane risk management for pharmaceuticals, which evolved into LARA (Lane Analysis & Route Advisor) in 2018. LARA is a project initiated by TU Eindhoven, CWI, VU Amsterdam as well as Panalpina, and Validaide. LARA also aims to optimize trade lane risk management but does not solely focus on pharmaceuticals but other special handling products as well, such as flowers, perishables, and dangerous goods. It also aims to investigate more innovative and advanced concepts along with challenges within this industry e.g. real-time information, compared to its predecessor DARA (LARA Project, 2019). The objective of this project is to develop one or multiple software tools for an Artificial Intelligence (AI) based route advisor, which in return will result in significant cost-saving, new business opportunities and avoid CO2 emissions.

This research is part of the LARA project and aims to investigate knowledge about planning shipments with special handling needs, with specific trade lanes and its carriers, stakeholders, options, and capabilities. In short, it aims to explore the alternatives of the choice set for the routing options. This is a critical first step into the digitalization of the sector. The purpose of this research is to find the appropriate technology to structure and transparentize the knowledge concerning the special cargo to make it applicable and functional.

1.5. Problem Statement

The main issue of the special cargo is that the reluctance and incapability to innovate has caused great inefficiencies within this industry. Different innovations could aid the goal of innovating the logistics sector. By the means of the LARA project, Validaide and its partners approach the issue through an artificial intelligence artifact that advises possible routes for a forwarder or manufacturer of special cargo. This is to digitalize the manual forwarding process of special cargo, which currently done manually and is inefficient and time-consuming. However, to artificially optimize route options, knowledge needs to be acquired, structured. This must create

the ability to use this knowledge. Considering this problem, the following main research question was formulated:

“In which way should a knowledge structure be constructed in order to support the planning phase within the special handling cargo sector?”

This research question is broad on its own and will be divided into more specific sub-questions in the following chapter.

2. Research Design and Principles

In this chapter, the methodology and design of the research will be discussed, as well as the principles that were created for the design to use as guidelines. Furthermore, the research objective, as well as questions will be discussed.

2.1. Research Methodology

The research is a qualitative, based on primary and secondary resources study, thus its methods are chosen accordingly. The design principles paradigm is applied as this thesis is artifact-based with the intention of functionality. The regulative model cycle is chosen, as a design or artifact will be created to intervene with the stagnation of the innovation rate within the special cargo sector. In Figure 1, one can find the cycle applied to this dissertation.

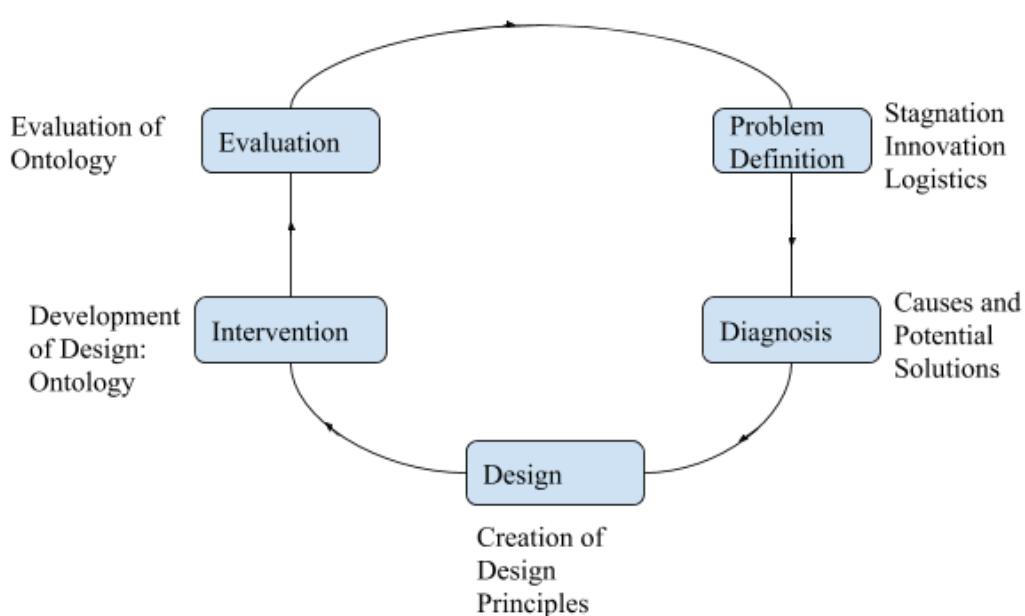


Figure 1: Design Principles Model Cycle

This methodological cycle is used to close the gap between the problem and the solution. The research questions apply to the phases of the circle. First and foremost, a review of academic literature and industry reports has illuminated a grand part of the theoretical part of this study, i.e. the problem definition. The next stage was the diagnosis, which is discussed in the introduction, once again based on academic literature and industry-relevant reports. The potential solutions are briefly mentioned. Based on the problem statement and its diagnosis, design principles are defined. These design principles will be the guidelines or considerations that a design needs to aim to adhere to. In the intervention phase, several solutions will be thoroughly discussed, and subsequently one solution will be chosen. The creation of this solution will be done based on a methodology that will be constructed. This methodology will be based on an analysis of existing methodologies. In this analysis, evaluation techniques will also be investigated. The artifact will be developed in the chosen software or platform, which will be the result of another analysis. Lastly, in the evaluation phase, the artifact will be evaluated based on the design principles as well as on with the discussed evaluation methods. This can result in adjustments or suggestions for improvement.

The sources consist of literature and information from domain experts, reports from consultancy bureaus specialized in logistics and freight, technology databases, such as Swoogle and SWSE, and the TU/e databases e.g. IEEE, Wiley Online Library, Scopus and CiteseerX, etc.

2.2. Research Objective

Based on the problem statement and the research methodology, the following objective was made:

To develop a knowledge representation of the special handling goods and services in the airfreight sector based on a designed methodology that will digitalize the determination of the choice set of solutions and routes for airfreight forwarders by making data transparent and understandable to machines.

2.3. Research Questions

The research question that applies to this objective is as follows:

“In which way should a knowledge structure be constructed in order to support the planning phase within the special handling cargo sector?”

This question will be answered with the help of these sub-research questions

- How can knowledge aid the digital transformation of the special cargo sector?
- Which is the best knowledge structure to aid the special cargo sector?
- What are the possible knowledge structure engineering methods?
- What are the specific knowledge requirements in the cargo sector?
- Which are the main and secondary concepts and attributes of the domain?
- How is the knowledge structure implemented?
- How is the knowledge structure evaluated?

2.4. Research Design

This study will research different methodologies for constructing a knowledge structure, build an applicable and appropriate methodology for the domain, and apply this methodology to the scope of the knowledge structure to get the relevant concepts and attributes. After that, these relevant concepts and attributes will be implemented into a software program to obtain an applicable product of the scope and domain. Finally, this product will be evaluated based on reviewed evaluation methods and adjusted accordingly.

It is expected that this final product can firstly be used as a structure of knowledge of the special cargo sector. Secondly, the expectation holds that another master student can use this structure to populate and enrich the knowledge structure. Subsequently, it is expected that the final product will be the base of an artificial intelligence (AI) route advisor based on the semantic web for the special cargo sector.

2.5. Design Principles

Based on the problem statements and its research objective, as well as on the knowledge collected about the problem and opportunities, the design should aim to adhere to the following principles aim to be a transfer or communication mechanism between academia and practice

General Design Principles

- The design should clearly state its purpose, so the user knows what the design has to offer to avoid unclear expectations (Vrandečić, 2009)
- The design should be useable for the intended users, in this case for the stakeholders within the special cargo sector (Vrandečić, 2009)
- The design should provide clarity over quantity, as it's more important to the stakeholders to have correct and useful knowledge than a multitude of it (Vrandečić, 2009)

- The design should be maintainable, as any data hardly goes without any updating. (Bos, 2003)
- The design should make use of expertise within the field (Vrandečić, 2009).
- The design should have longevity, which can be achieved through adhering to W3C standards. (Bos, 2003)
- The design should remain its stability throughout time, changes and additions (Vrandečić, 2009).
- The design should aim to create greater efficiency compared to the previous state where the design will be implemented.

Knowledge Structure Principles

- The design should offer clarity to effectively communicate the intended meaning of the defined terms (Fernández-López et al., 1997; Vrandečić, 2009)
- The design should be coherent amongst definitions and relations (Gruber, 1995)
- The design should be extendable, as it should be able to add new terms (Mizoguchi & Ikeda, 1998).
- The design should have a minimal encoding bias, as it should be independent of the issues of language (Hirst, 2009).
- The design should be able to successfully integrate with its reasoners or machines (Vrandečić, 2009).
- The design should have minimal ontological commitment to support knowledge sharing (Vrandečić, 2009).

2.6. Deliverables and Contributions

This research aims to make knowledge transparent and usable for the special cargo sector, in specific for trade lanes and its risk assessments. Currently, there have been studies and designs for knowledge engineering, semantic web, and knowledge base for logistics (Chow et al, 2005; Dong et al, 2008; Hofman et al, 2016; Preist et al, 2005), yet the special cargo largely remains uncovered topic. As will be explained thoroughly in the theoretical background, due to the richness that ontologies can apply to knowledge, and its wide area of application e.g. the semantic web, it will be used as the structure of knowledge of the special cargo domain for this study. This will be further discussed in section 4.4. The creation of a special cargo ontology can be done through several methodologies. Ontology creation will be further discussed in the theoretical background, but it is in essence associated with the formal structure in the mind of

an ontology engineer. This implies that the ontology depends on the creator of the ontology, as it's based on their judgment. This deduction agrees with the statement that Noy and McGuinness (2001) made that there is no correct way to modeling a domain or building an ontology, it's a creative process that will differ with every individual. As mentioned, a domain or application-specific ontology is needed. Due to these specifications, a new methodology will be created to optimize this task, which will deliver a unique ontology. Furthermore, this thesis will implement knowledge acquisition tools and techniques in a full ontology methodology, an area that has much left to be discovered, especially in the field of logistics.

2.7. Structure of the Thesis

The following chapters are arranged according to the design cycle. As the problem definition and diagnosis are fulfilled and the design principles, the next step is the intervention. First, the possible solutions to the problem will be thoroughly discussed in chapter 4. As mentioned previously, before these solutions can be implemented, a knowledge structure needs to be made to efficiently use this knowledge within the solution. The creation of this knowledge structure will be done according to a methodology. The methodology components will be assessed in chapter 5. The created methodology with the assessed components will be discussed in chapter 6. The following chapter, 7, will incorporate the created knowledge structure or also referred to as the artifact. In chapter 8, this artifact will be evaluated. The final chapter will consist of the conclusion and recommendation.

3. Theoretical Background

3.1. Knowledge

As mentioned in the introduction, several knowledge innovations could solve the transparency problem of the special cargo industry. Knowledge engineering, semantic web, data mining, natural language processing are different paradigms in knowledge innovation. These paradigms all use knowledge to some extent, but it's essential to understand what knowledge truly is. Knowledge has different definitions within several fields. Philosophy, for example, argues that knowledge is justified true belief or the result of a reasoning process (Bolisani & Bratianu, 2018). The dictionary has several definitions but mainly described the concept as "the fact or condition of knowing something with familiarity gained through experience or association" (Merriam-Webster, nd). Computer science has a practical approach and argues that knowledge is rich and highly structured information, as well as what is required to perform complex tasks (Milton, 2007). It's more than shallow information. However, without proper structure, accessibility, or application of knowledge can't be useful. Several research fields or technology paradigms concern knowledge. The hovering question remains which one is suitable.

3.2. Knowledge Research Fields

Knowledge Engineering (KE) is the first research field one encounters when investigating knowledge innovation. KE is the activity that purposefully abstracts parts of reality to model it for a system (Schreiber et al., 2000). This system is known as a Knowledge-Based System (KBS). These topics will be further discussed in section 4.2. Knowledge-Based Engineering (KBE) is a sub-domain of knowledge engineering that aids design engineers through "the use of advanced software techniques to capture and re-use product and process knowledge in an integrated way" (Stokes, 2001). KBE is focused on improving engineering and manufacturing product development through the help of engineering knowledge. This, however, does not comply with the objective of this dissertation, as the main objective is to structure knowledge and use this as the base of an AI route planner, rather than implementing this knowledge for manufacturing or computer-aided design. As Chapman and Pinfold (1999) inferred, KBE is the discipline of combining a Knowledge Base System and Engineering, therefore being Knowledge Based Engineering. This implies that the methods KBE uses are similar to KE in terms of extracting knowledge. Therefore, the discipline won't be considered for this research as there is no added value compared to the overlapping paradigm of knowledge engineering.

A different paradigm that does focus on knowledge obtainment but from a specific source is data mining. Data mining is the process of extracting knowledge from vast amounts of data (Li & Beaubouef, 2010), which is stored in a database. While this area is highly efficient in many ways, it won't suffice for the special cargo industry. The problem lies in the non-transparency of data, information, and knowledge, thus there is bare to no available data to perform mining on. For this reason, this technology won't be taken into consideration for the final design.

Another crucial paradigm of knowledge is Artificial Intelligence. As mentioned before, the LARA project aims to create an AI-based route advisor. AI is a broad research field and its definition has changed over the years. In 1956, the term was meant to answer the question if a computer was possible of imitating human-like intelligence, nowadays the discipline aims to make machines intelligent (Stone et al., 2016). Intelligent in this context is that “quality enables an entity to function appropriately and with foresight in its environment (McCorduck & Cfe, 2004). Over the years, AI has extended its branches and developed new research fields. Machine learning, for example, seeks to answer the questions “How can we build computer systems that automatically improve with experience, and what are the fundamental laws that govern all learning processes?” (Mitchell, 2006). Robotics is another field within AI, that focusses on the physical aspect of AI (Stone et al., 2016). Both of these technologies are very capable and effective, it does not match to the objective of this research, as the primary goals are to structure knowledge and then eventually apply it. AI also branches out into the semantic technologies, which can be defined as the technologies that derive meaning from information or data (Cambridge Semantics, 2019). In specific, the semantic web is vastly related to the AI concept, that aims to resemble human understanding, but in this case, machines understanding each other through human concepts. The difference with AI lies in the fundamental parts of the semantic web. First off, semantic technologies use the web, an open world, to use reasoning on whereas AI is considered closed world (Halpin, 2004), which in return affects the innumerable amount of data that semantic web deals with compared to artificial intelligence that gathers its data from a database. Furthermore, AI does not use RDF yet (Halpin, 2004) as it's “the standard model for data interchange on the web” (World Wide Web Consortium, 2014), which is the main part of semantic technology focus. Lastly, both the semantic web and artificial intelligence use ontologies as the structure of a knowledge base, but both diversely.

A research field that overlaps with AI, semantic technologies, as well as the process of extracting knowledge, is Natural Language Processing (NLP). In brief, NLP is the computational process of analyzing text, text generation, speech analysis, and generation of

dialogue systems with the purpose of achieving human-like language processing to serve applications or tasks (Liddy, 2001). The ultimate goal is to employ computers that understand and can manipulate natural language. This discipline is useful for extracting knowledge from experts, as it can also be applied to speech, as well as documents. This field of extracting as well as applying knowledge could be useful to the special cargo sector as it aims to translate the human language. Often, the knowledge of the special cargo domain is non-comprehensible for machines, NLP could be used to bridge this gap. NLP can be implemented in multiple ways, either through tools (e.g. OntoLearn) or algorithmic coding, and it can also be used for multiple purposes, such as term extraction or population of a knowledge base.

In the following sections, knowledge engineering, semantic web, knowledge structures, and ontology will be discussed.

3.3. Knowledge Engineering

3.3.1. Background

The special cargo industry needs a technology that not only can summon and compare knowledge but also apply this in an application or task. Knowledge Engineering (KE) closely resembles this goal. KE is an offspring of Artificial Intelligence and according to Schreiber et al. (2000), the most industrial and commercial one. First, knowledge engineering was merely seen as extracting knowledge from the domain expert and digitalizing this to create a system (Schreiber et al., 2000). Now, it has evolved into a similar structured approach as software engineering with techniques to acquire knowledge and intending to construct a system, or KBS, that explicitly represents knowledge within the system for an organization (Studer et al, 1998). A KBS consists of a knowledge base and a reasoning or inference component (Gobin & Subramanian, 2009). A KBS, the result of the process of KE, is supposed to solve an amplitude of problems alongside benefiting an industry of company with faster decision making, increased productivity, and increased the quality of the decision making (Schreiber et al., 2000). A KBS is often used as the base of knowledge management. Knowledge management in this context means “the management process of creating, sharing and using organizational information and knowledge” (Girard & Girard, 2015). The goals of both disciplines are alike as they both aim to share knowledge and increase productivity and faster decision making and build upon the yield of Knowledge Engineering. The process behind engineering knowledge, therefore, needs to be detailed and structured. Preece et al. (2001) offered the outline of the process as follows:

1. Requirements Analysis which consists of identifying the scope of the KBS
2. Conceptual modeling which consists of creating a glossary of terminology for the relevant domain. The result of this step is an ontology.
3. Knowledgebase reconstruction which consists of applying instances to the ontology
4. Operationalization and validation which consists of operationalizing the created knowledge base from step 3, through automated reasoning mechanism and validate this against the requirements from step 1. Repeat step 1 to 4 if the knowledge base is not satisfactory
5. Refinement and maintenance which consists of steps 1 to 4 throughout the life of the knowledge base, as knowledge is added and changed.

As mentioned before, creating a knowledge base structure is the scope of this study. Therefore, step 3 won't be executed within this study. Step 4, with automatic reasoning, will not be applied, does not lie within the scope, as is explained in 4.2. However, the knowledge base structure does require validation.

The application within knowledge management will also be omitted, as this implementation isn't objective of this research. However, in both the beginning stages of building a glossary and eventually an ontology complies with the purpose. Knowledge management will be used as a guideline in the initial phases but not as an application, similar to KE.

3.3.2. Principles

As the knowledge engineering field has evolved since the mid-1980s, the engineers have developed several principles and tools that improved the beginning part of the process, the knowledge acquisition as well the final stages of the process, documenting the knowledge. These differ over the years, but the following principles are the main principles (Schreiber et al., 2000; Darai et al., 2010).

- Knowledge engineering is more than gathering knowledge from an expert. There are different sources and types of knowledge, as well as different types of experts and expertise.
- Knowledge has a stable internal structure, that can be found through structured methods.
- The knowledge level principle, which entails that one must first focus on the conceptual structure of knowledge before continuing with programming.
- Knowledge can be represented as well as used in different ways.
- In a project concerning knowledge, one must learn from the experience in a controlled, but not rigid manner.

These principles are based on research and experience and can be used as a guideline or baseline for knowledge engineering.

3.3.3. Methodologies

To build a KBS, one must first acquire rich and structured information. This is called knowledge acquisition. The extraction from merely a domain expert is called knowledge elicitation (Shadbolt et al., 2015). There are several methods and methodologies on how to acquire

knowledge, as well as how to build a KBS. Two methodologies that focus on problem-solving within knowledge engineering are MOKA and SPEDE. MOKA (Methodology and tools Oriented to Knowledge-Based Engineering Application) focuses on the capture process in knowledge base engineering application whilst SPEDE (Structured Process Elicitation Demonstrations Environment) is mainly used within Business Process Redesign (BPR) or Improvement (BPI) projects (Chernbumrong et al., 2018). A more common as well as more broad methodology is CommonKADS. CommonKADS is built on years of research of knowledge engineering that started in 1983 and has been adjusted and improved over the years (Schreiber et al., 2010). Common Knowledge Acquisition and Document Structuring, or CommonKADS, is a methodology focused on finding, capturing and documenting organizational knowledge, mainly to support knowledge management within an organization. This methodology divides the knowledge model into three parts, domain knowledge, task knowledge, and inference knowledge. It follows similar steps as to the outline of Preece et al. (2001) but enquires more steps, namely:

1. Organizational Analysis
2. Business Process Analysis
3. Knowledge Elicitation
4. Knowledge Capture
5. Knowledge Modeling
6. System Development
7. System Test

The similarity among the methodologies previously mentioned is the initial focus on acquiring knowledge, so it later can be used (Staab & Studer, 2010). As this is the focus of the special cargo industry, the initial phases of the methodologies are of interest. In the later phases, these methodologies focus on organizational knowledge and knowledge management, which is not yet the focus of the cargo industry. Therefore, the initial focus of knowledge acquisition of the CommonKADS method will be of relevance to the objective, therefore its techniques will be taken into consideration.

3.3.4. Knowledge Acquisition Methods

There are specific methods for the knowledge acquisition phase within the knowledge engineering field as well as in other fields. Milton (2007) dedicated a book to these techniques

and tools, Gaines (2004) developed a model specifically for organizational knowledge acquisition, Hoffman et al (1995) analyzed knowledge elicitation techniques, and even in 1990, Welbank, as well as Akhavan et al. 2011, made an overview of different techniques for acquiring knowledge. Nezafati et al. (2007) examined human knowledge acquiring techniques. As mentioned before, there is a difference between knowledge acquisition and elicitation. While these papers often refer to ‘acquisition’, they associate this as just a part of the process. Knowledge acquisition is the whole process which concerns acquiring the knowledge, including the planning and analysis of the knowledge extraction (Chen, 2004; Liebowitz, 2016). The actual techniques research referred to, are elicitation techniques, as they focus on extracting knowledge from experts within the domain (Hoffman et al, 1995). These techniques will be thoroughly discussed and evaluated in the next chapter, but the main knowledge elicitation techniques are; Interviewing, Protocol analysis, Laddering, Concept sorting, and Repertory grids. These techniques all have the similarity that they are manual techniques alongside that they are not cutting-edge but can be considered classic. These classics do have their differences. These techniques are dissimilar in intensity, difficulty, and stage application which can result in certain techniques having higher efficiency in a particular situation.

While establishing that the manual techniques lack high tech innovations, these techniques are not obsolete. There are however more current and innovative techniques that can be applied in the knowledge acquisition process. These techniques are called semi-automatic or automatic ontology acquisition techniques, or ontology learning techniques. This is a separate research field that overlaps with AI and ontology engineering. These techniques vary in fields such as NLP, machine learning, information retrieval, data mining, and knowledge representation, and all helped in ontologies development (Asim et al., 2018).

3.4. The Semantic Web

3.4.1. The Web

A technology that focuses on creating and using digitalized knowledge is the semantic web. The term ‘Semantic Web’ has been around since it was introduced in 2001 in a paper by Berners-Lee, Hendler, and Lassila. In this paper, the semantic web was described as “not a separate Web but an extension of the current one, in which information is given well-defined meaning, better-enabling computers and people to work in cooperation”. They envision that in the future, software agents will roam the web and in return execute tasks for end-users e.g.

booking appointments without any human interference. For the semantic web to work, computers and machines must be able to conduct automatic reasoning that is made possible through structured sets of information and inference rules. Computers use these rules to make new facts e.g. new appointments that are inferred from known facts such as schedules. In technical terms, the semantic web should be able to merge and query data from distinctive sources across the web (Sanaei et al., 2013). The current web, or the synthetic web, is a web of documents, where the semantic web is a web of data. With the synthetic web, documents can be found through links, which the devices can open but not read. To distinguish relevant documents or links, one must go through each document to find the information one is looking for (Hendler, 2010). In the semantic web, the computer understands the information written in the documents, due to the semantic knowledge it has of that domain.

The semantic web is often used interchangeably with the term ‘web 3.0’ (Hendler, 2009; Agarwal, 2012), also referred to as the semantic web + web 2.0 (Wahlster et al., 2006). Web 2.0 is the upgrade from web 1.0 which was a unidirectional web, whereas web 2.0 makes it a platform, with collective wisdom through the usage of communities and data sharing. However, the limitation to web 2.0 is that is comprehensible for human beings, but not for computers and devices. Web 3.0 aligns the semantic technologies with web 2.0, as mentioned by Wahlster et al (2006), ensuring that machines understand this new version of the world wide web. Another term closely related to the semantic web is linked data. As defined by the World Wide Web Consortium (2015), linked data is the collection of datasets that maintain relationships among data and that is presented in a standard format that is can be conducted by the semantic web. In other terms, the semantic web uses linked data to integrate data and use inference on data.

3.4.2. Semantic Technologies

As mentioned, the web 3.0 aligns semantic technologies with the web, but the question remains what semantic technologies are. Semantics is the study of meaning (Merriam-Webster, nd), but in terms of technology means the study of the meaning of data to machines and devices, or rather make machines truly understand data (Cambridge Semantics, 2019). Sugurmaran (2016) argued that semantic technologies aide to the creation of an environment where data and information is well defined and understood by both people and computers and allows for intelligent techniques to be applied. Besides the semantic web, other semantic technologies aim for similar goals. Semantic technologies generate a vast amount of new data from the information that already exists on i.e. databases based on logic and knowledge (Sanaei et al.,

2013). The semantic web does the same data extraction upon the current principles and technologies of the web (Grimm et al., 2011). As mentioned before, Natural Language Processing is an example of a semantic technology as it also aims to study human language and translate in such a way that machines and computers understand, yet it is not bound to the world wide web.

3.4.3. Components of the Semantic Web

This technology consists of many layers, which can be found in Figure 2. The base of Figure 2 consists of identifiers and a character set. URI stands for Unique Resource Identifiers, which are unique ID's to identify properties that are an equivalent concept (Linked Data Tools, 2010).

UNICODE is a character set that is used to convert the characters into numbers that the computer can understand (Korpela, 2006). The syntax is XML, eXtensible Markup Language, which is the standard format of the World Wide Web Consortium on how to structure data. On top of this syntax, one can find the method of data interchange, RDF – Resource Description Framework. This is the foundation of defining data on the semantic web, as it's used to generate metadata structures that delineate data on the web (Roussey et al., 2011). RDF is composed of RDF triples. These triples consist of the subject, the predicate, and the object, where the predicate can be seen as the relationship between the other two variables. On top of these RDF triples stands the RDFS – RDF Schema which accounts for the taxonomy within a semantic web. The official term of RDFS is RDF vocabulary description language, which means that RDFS is a vocabulary of combinations of RDFs including definitions. Taxonomies are the static base of the semantic web, whereas the next layer, ontologies in combination with OWL, adds dynamic and inference to the technology. OWL is the ontology web language and gives meaning to these taxonomies. Upon the ontology, the layers of proof and trust are established. These layers consist of making the semantic technology ‘think’. To query semantic data, SPARQL is used, which is a W3C standard. The final layer is the semantic web made functional, through applications and interfaces (Domingue et al., 2011).

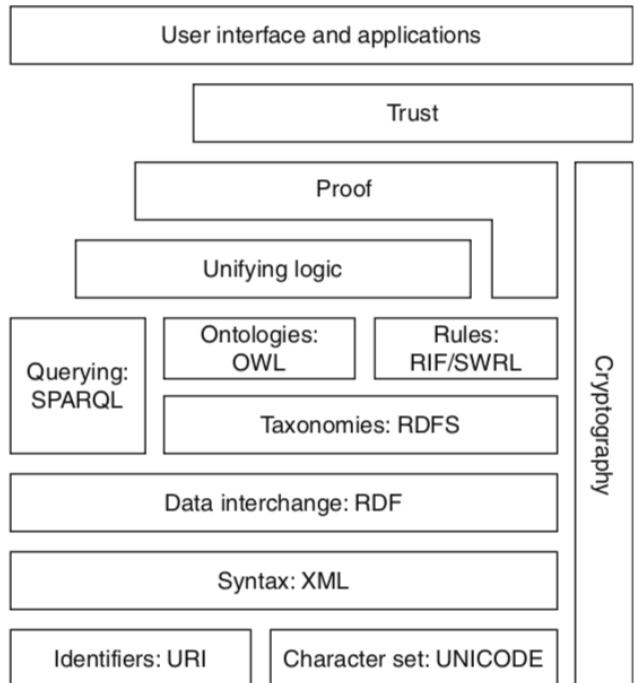


Figure 2: The Semantic Web Layer Cake (Domingue et al., 2011)

3.5. Knowledge Bases and Structures

Semantic technologies, knowledge engineering as well as artificial intelligence in general, share similarities amongst them. First and foremost, the semantic web needs machines to conduct automatic reasoning through the means of structured sets of information and inference rules. Two main KBS components are a knowledge base and an inference machine, which are similar to the semantic web necessities. AI also needs information or knowledge to imitate human intelligence. The structured sets of information, in essence, is equal to the definition of a knowledge base. Knowledge bases, in essence, represent machine-readable information (Martinez-Cruz et al., 2012). They storage the knowledge thusly that application or other technology can call upon this knowledge. This definition is very similar to one of a database, which is “a usually large collection of data organized especially for rapid search and retrieval (as by a computer)” (Merriam-Webster, nd). The difference is that a knowledge base is a type of database, but a database does not necessarily offer knowledge. Yet a knowledge base is always filled with data. Furthermore, there is a clear distinction between a knowledge base and a knowledge structure or model. For a knowledge structure or model to function as a knowledge base, individual instances should be applied to the structure (Song et al., 2009), thus adding instances to a knowledge structure results in a knowledge base.

As the distinction is made between structure and base, there are also distinctions between the different kinds of knowledge structures. An excel sheet could also be considered a knowledge structure, as it labels entities and aims to structure knowledge. However, there are more advanced types, i.e. when hierarchies and relationships amongst entities are considered. The two prominent and more advanced knowledge structures are ontologies and database models. A thorough definition of ontologies will be discussed in the next section, but in short, ontologies store knowledge of a domain through a set of concepts and categories and shows their properties and the relationship among them. One type of database is a relational database. Other database models, such as a hierarchical database or a flat model, have tried to surpass the relational database but fail due to the popularity of the relational database gained through the richness and complexity of storage information (Martinez-cruz et al., 2012). Relational databases, as its’ name indicates, are built on a relational model. In 1970, E. Codd revolutionized databases by structuring data in a relational view (IBM, 2018), where data is stored in tables with columns and rows, where a record can have a ‘relation’ to another table. The relational aspect is an upgrade from simpler databases, yet misses aspects compared to ontologies. Martinez-Cruz et al. (2012) argue that “ontologies have involved a revolution in the area of computation science,

specifically in artificial intelligence and database discipline” due to its capability to represent reality.

3.6. Ontologies

3.6.1. Background of Ontologies

The word ‘ontology’ has different meanings in different fields. The term ontology first arose within psychology. In this line of study, ontology defines as “a systematic explanation of being” (Corcho et al., 2003), and studies the nature of being, as well as categories of being and relations. Later on, artificial intelligence and knowledge engineering used the term ‘ontologies’ as extensive knowledge structure (Berners-Lee et al., 2001). Ultimately, within the AI community, the following quote is used primarily to explain ontology, “An ontology is a formal, explicit specification of a shared conceptualization” (Studer et al., 1998). ‘An ontology’ is a computational artifact opposed to its psychology counterpart that envisions ‘ontology’ as a science. Ontologies are referred to as the key role in the vision of the semantic web (Grimm et al., 2011), as ontologies are the semantic vocabulary that is used to indicate meaning to initially meaningless data for machines to interpret in such manner that these logic impaired devices understand and can use this data to complete tasks without any human interference.

The field of research ontology engineering was first proposed in 1998 by Mizoguchi & Ikeda, and they defined it as a methodology towards modeling knowledge bases, in terms of concepts in combination with theories and technologies. They also offer different insights into the usage of ontologies. The definition of the concept ‘ontology engineering’ has changed over the years. In 1998 (Mizoguchi & Ikeda), it was mostly seen as the creation of ontology but does mention that it is supported by sophisticated theories and technologies. It was initially focused on the construction of ontology languages, tools such as Protégé, and methodologies e.g. METHONTOLOGY, but nowadays the ontology engineering field concentrates on developing re-usable central pieces of knowledge (Corcho et al., 2015). A term that emerged over the years of ontology engineering is ontology learning. Ontology learning focuses on learning ontologies from structured and unstructured resources in a (semi) automatic way (Cimiano et al., 2006), omitting the laborious process of manually creating ontology with technology. It’s also referred to as the automatic or semi-automatic process of creating an ontology (Wong et al., 2012). The learning can be done through term extraction, co-occurrence analysis, clustering, and other text mining and machine learning techniques (Asim et al., 2018).

Whilst ontologies have a rich background, this is not the justification for using an ontology opposed to other knowledge structures or bases. As Martinez-Cruz et al. (2012) argued, ontologies are itself richer compared to other knowledge structures in many aspects. The major characteristics of ontologies are i.e. the relationships amongst terms, concepts and hierarchy and the depth that is allowed to each term (Asim et al., 2018). These characteristics allow for ontologies to work like a coherent entity similar to a brain. Database structures aim to store data, while ontologies aim to add meaning and comprehension and additionally can serve as a communication bridge between humans and computers (Sir et al., 2015). Furthermore, the shared aspect of the primary quote is a great advantage over other knowledge bases as it accommodates the easier integration and sharing of knowledge (Studer et al, 1998). Furthermore, the application of ontologies is broader than a simpler database. The semantic web can be seen as a successful application of building on these cores of knowledge as well as language processing, e-commerce, database design, bioinformatics, and so on (Gómez-Pérez, 2004). Within this semantic aspect, the semantic web has the advantage over AI that it's open world as opposed to closed. Ontologies have the same advantage over database structures. Additionally, ontologies are used to specify knowledge that is exchanged and shared between the different systems, and within the systems by the various components, in a standard way, thus not one system or component as most structures (Vrandečić, 2009).

Whilst the academic reasoning support the usage of ontologies, the nature of the special cargo industry also offers support in the choice of constructing an ontology rather than another type of knowledge structure. As mentioned, this industry requires structuring as the knowledge is non-transparent and data is hard to access. An ontology offers not only the possibility to represent reality in a structured manner, but also present feasibility to structure the content of web pages, as this is where the availability of special cargo data can be found.

3.6.2. Components of Ontologies

An ontology can be subdivided into different levels, also known as the ontology learning layer cake. The visualization differs from one paper to the next (Asim et al., 2018; Buitelaar et al., 2005; Grimm et al., 2011) but the core of the ontology layer can be found in Figure 3. While ontology learning refers to the (semi) automatic generation of ontologies, this layer cake can also be considered in the manual creation of ontologies, as the variables within the cake are still relevant. The base of each ontology is all the terms related to a certain domain. Built upon terms are synonyms, connecting one term who is a synonym to another. The core of the cake is the concept layer. It's the overarching concept of the overall related synonyms. For example, aircraft is a synonym to airplane, or plane or aero plane. The following layer, concept hierarchies, defines which concepts are part of each other, for instance, UFO to aircraft. The following layer of the cake is how a non-hierarchical concept relates to one another, e.g. plane to its passenger. The rules, or axioms, are where the ontology gets ‘logical’, e.g. UFO is an unidentified flying object, so it is not identified, or the pilot of an aircraft is not a passenger. These layers together form the ontology.

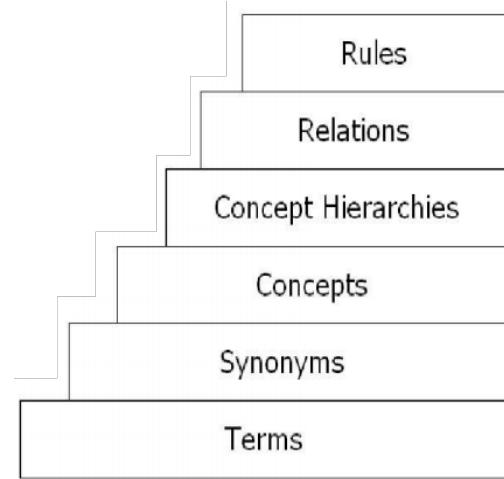
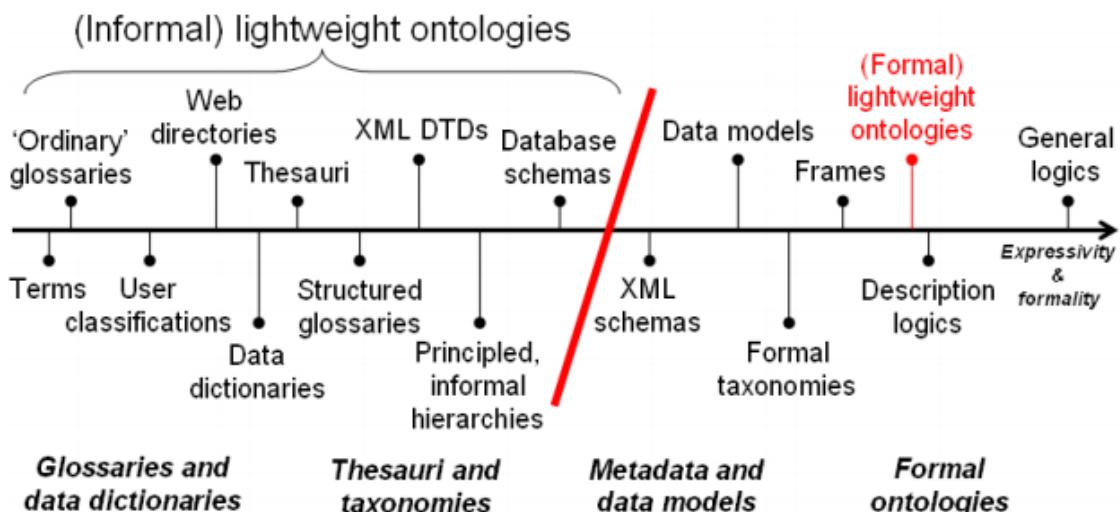


Figure 3: Ontology Learning Layer Cake
(Buitelaar et al., 2005)

3.6.3. Types of Ontologies

There are also different types of ontologies, as portrayed in Figure 4, based on the degree of formality and expressivity of the ontology (Giunchiglia & Zaihrayeu, 2009), also known as the

Figure 4: Ontology Spectrum (Giunchiglia & Zaihrayeu, 2009)



ontology spectrum (Lassila & McGuinness, 2001). As it moves up in the spectrum, their expressive requirements grow. Thus, as more complexity is required, logically more elaborate techniques are needed to fulfill these requirements. Due to the complexity of the special cargo domain, alongside the hypothetical applications of the ontology and the need for structure within the domain, a formal lightweight ontology as indicated on the spectrum (Figure 4), is the minimum required level of formality.

Furthermore, there is also a distinction between approaches in constructing an ontology. There are two main approaches, namely, bottom-up and top-down. In a top-down approach, the ontology primarily focuses on general concepts and relationships on an abstract level. Subsequently, these components are refined. This is often done manually (Staab & Studer, 2010). Bottom-up starts on the other side, where one semi-automatically extracts terms from a corpus of documents and consequently builds concepts based on the extract terms. A hybrid of these two approaches is the middle-out modus, which Staab and Struder (2012) define as “to identify the most important concepts which will then be used to obtain the remainder of the hierarchy by generalization and specialization”. As indicated by Klischeweski (2003), a formal ontology is specified by a collection of concepts and relations, rather than informal which “may be specified by a catalog of types that are either undefined or defined only by statements in a natural language”. With this statement alongside the formality that is indicated for this ontology, a manual top-down is the chosen approach.

4. Analysis

4.1. Ontology Methodologies

As the components and reasonings of the ontology are discussed, the next step is to pick or create a methodology. A methodology consists of several steps and aspects that aim to fulfill the task of creating an appropriate ontology. As the approach of ontology creation is top-down, a manual methodology will be elected. There have been several methodologies for ontology development proposed the last three decades (Iqbal et al., 2013), there are still many academics argue that the ontology engineering research field is inferior compared i.e. software or knowledge engineering (Iqbal et al., 2013; Suárez-Figueroa, 2010; Corcho et al., 2003). This argument led to the suggestion of the creation of a new methodology. Another argument for a new methodology stems from the (situational) method engineering discipline, which pleads that it is unlikely that one standard fits all, thus different situations ask for different methodologies (Brinkkemper, 1996; Henderson-Seller & Ralyté, 2010). Furthermore, the ontologies often do not take the knowledge engineering acquisition methods. The created methodology aims to combine these factors to present a thorough and detailed guide with tools and methods to create an ontology.

For the analysis of existing methodologies as well as the creation of a methodology, the ontology life cycle will be discussed first. The execution of the steps of methodologies can differ, but the life cycle follows a similar pattern. This life cycle will be later used as an outline of which steps are fundamental in building an ontology. Next, the core methodologies in the field of ontology engineering will be discussed along with their advantages and disadvantages. As mentioned, specific situations have specific needs, thus there are specific aspects that need to be present within the methodology in order to be appropriate for the special cargo domain. One of these needs is acquiring knowledge. As ontology methodologies often offer few methods on knowledge-gathering, these methods will be extracted from another field. Thus, after discussing the core methodologies, different methods from the field of knowledge acquisition will be considered. Following this, the area of ontology editors will be discussed and reviewed. Finally, different ontology evaluation methods will be reviewed respectively. The final assessment of each of these components will be done in chapter 6, where each final choice of the component will be elected.

4.1.1. Ontology Life Cycle

An ontology life cycle is defined as a model to describe how to develop and maintain an ontology, or how to organize the processes and activities of creating an ontology (Suárez-Figueroa, 2010). This life cycle will be used as a holistic view of a methodology so that methodologies can be compared to the life cycle and thus be compared to each other. Based on De Nicola et al. (2005), Suárez-Figueroa (2010) and Sure et al. (2004), the following life cycle was constructed:

1. Initiation phase
2. Conceptualization and reuse phase
3. Implementation phase
4. Maintenance phase

The first phase, the initiation phase, consists of creating ontology requirements. While there are different methods on what these requirements fully entail, how to create these requirements and how they are documented, the requirements themselves must be formulated. This phase might or might not entail the planning of the ontology, depending on the methodology. The second phase consists of the structuring of the domain knowledge. This is where a glossary is built. The building part of this phase is, according to Suárez-Figueroa (2010), not a necessity but can be useful due to the shifting of the ontology paradigm. Suárez-Figueroa argues that ontology development has shifted from creating ontologies from scratch to reusing and reengineering available and fitting knowledge sources. Other academics also praise the reuse of ontological resources (Noy & McGuinness, 2001; De Nicola et al., 2005). The implementation phase entails the implementation of the formal model in an ontology language i.e. OWL or RDF. The result of this phase is an ontology prototype that will be tested, evaluated and maintained in the maintenance phase. Missing knowledge and errors will be adjusted in this phase.

4.1.2. Methodologies

In this chapter, the most mature and used methodologies will be briefly explained and compared to the life cycle as well as detail, and conformity to the cause. In the next chapter, they will be assessed, and one methodology will be elected.

Two oldest known ontology methodologies are the Enterprise Ontology by Ushold and King (1995), and the TOVE by Grüninger and Fox (1996). The Enterprise Ontology is specified for business enterprise modeling processes and was also the first methodology for building ontologies. Before the Enterprise Ontology, it was thought that guidelines for building ontologies were plentiful (Iqbal et al., 2013) but Ushold and King argued differently. While Ushold and King were the first to create an ontology methodology, the details within the methodology are lacking and the techniques and activities are not discussed thoroughly. They do not propose a lifecycle themselves, but in comparison to the constructed lifecycle they are missing the planning aspects, they are severely lacking in the maintenance phase. The reuse of ontologies is not discussed at all. Lastly, the focus on organizational knowledge is overarching throughout the methodology which makes it undesirable for a domain knowledge-focused ontology.

A year later as Ushold and King, Grüninger and Fox (1996) designed the TOVE (TOronto Virtual Enterprise) methodology, based on the development of the TOVE project ontology. Like the enterprise methodology, its focus lies in business processes and activities modeling. TOVE focuses on the technical side of creating an ontology but the methodology lacks details to the techniques of the conceptualization phase. It does entail a maintenance phase but does not propose a life cycle themselves. Similar to the Enterprise ontology, the focus on organizational knowledge remains grand and lastly, it is also semi-dependent on the enterprise workbench thus decreases the fit with the cause.

One of the most mature and known methodologies for building ontologies is METHONTOLOGY, created by Fernández-López, Gómez-Pérez, and Juristo in 1997. While being over 2 decades old, the authors improved and revised it several times. The in-depth description of the steps to be taken as well as pre-development activities and ontology life cycle based on evolving prototypes makes that this methodology is considered to be one of the most mature according to Iqbal et al. (2013). The METHONTOLOGY also endorses the use of reusability. It is partly bound to ODE, an ontology engineer workbench, but it's not a necessity

in using the methodology. This means that the objective of this methodology overlaps with this study's objective.

Another methodology is the 101 method. In 2001, Noy and McGuinness developed an iterative approach for modeling a domain. It consists of 7 steps which are similar to the life cycle proposed in this chapter, yet Noy and McGuinness fail to make a life cycle recommendation themselves. The process is however explained in detail and also discusses the pros and cons of different solutions and complex issues within certain steps. Whilst it is not application or domain-dependent, this guide is expressed in such a language that it's understandable for laymen but might be too basic for heavyweight ontology engineers as it is aimed at one's first ontology development. There is a definite overlap between the study's and the methodology's objectives.

UPON, which stands for the Unified Process for ONtology building, is an incremental approach for building an ontology. It's based on Software Development Unified Process, a known and accepted method in the software engineering industry. This methodology was proposed by De Nicola, Missikoff and Navigli in 2005. De Nicola et al. argue that the distinction between UPON and other methodologies is the "use-case driven, iterative incremental nature". The methodology does entail a life cycle concerning which phase applies to which workflow. The methodology is highly scalable and customizable (De Nicola et al., 2009) however, it lacks details and thorough explanation of steps. Lastly, it is application- and domain-independent. In 2016, De Nicola & Missikoff created UPON lite, which focuses on non-knowledge engineers and domain experts whilst using the UPON philosophy. While lite does not conform to the objective of the research, the UPON original entails elements that are of interest to the end goal of this thesis.

On-To-Knowledge Methodology, also known as OTKM was developed by Sure, Staab, and Studer (2004) and was issued to introduce and maintain Knowledge Management into enterprises through the help of ontologies. The focus of this methodology is Knowledge Processes and Knowledge Meta Processes. Its main goal is to connect IT solutions and human problem-solving skills. Just like Ushold & King (1995) and Grüniger & Fox (1995), this methodology is focused on enterprises, but in contrast, it is very detailed in its process description, specifically with its example case. It is also considered to be one of the more mature methodologies (Roussey et al., 2011). This methodology does have some details to the techniques and steps but not throughout, it also does have a life cycle recommendation, yet it

is application dependent, namely knowledge management which is not the focus within this study.

One of the more recent methodologies is introduced in 2009 by Seremeti & Kameas, which is explained to be an approach that combines activities by other methodologies, based on the needs of a novice ontology engineer. They differentiated the activities upon different scenarios, to fully fit the needs of the ontology building. The methodology does mention lifecycle components, but it also does lack a thorough discussion of the steps within different scenarios, but it is, however, a compendious approach due to the different scenarios and aims to get the best out of all other methodologies. It is not application or domain bound, but due to the severally lacking details, it is a scarce fit with the focus of this study.

Other methodologies are DILIGENT, NeOn methodology, Ontoligua, PLINIUS, ONIONS, Mikrokosmos, MENELAS, SENSUS, Cyc methodology, and Bernaras. These are not discussed for several reasons divided amongst the methodologies. First, some are mere guidelines while others can be considered more of a library. Furthermore, DILIGENT is primarily focused on collaborative ontology engineering which is not a priority, and NeOn is focused on ontology networks. (Suárez-Figueroa, 2010)

4.2. Knowledge Elicitation Tools

As briefly discussed in section 4.2.4, there are two main types of knowledge acquisition tools. The knowledge elicitation type and the (semi) automatic ontology acquisition type. First, the knowledge elicitation techniques will be discussed. In Table 1, different techniques are elaborated.

Table 1: Knowledge Elicitation Techniques

Technique	Explanation	Studies
Unstructured interviews	This technique consists of general questions, not pre-defined asked to an expert. This technique might take longer as the goal is to explore the domain.	[1][2][3][4] [5][6][7][8] [9]
Semi-structured or prompted interviews	This technique consists of pre-prepared questions, as well as questions that arise during the interview for clarification. This technique is more efficient than unstructured interviews, as there is background knowledge which the questions are built upon.	[3][5][8][9]

Structured interviews	This technique consists of pre-prepared questions often in a pre-defined order. These questions are more specific more closed than the previous techniques which allow for easier transcription as well as higher efficiency. High background knowledge is required.	[1][2][3][4] [5][6][7][8] [9]
Twenty questions	This technique consists of the expert asking closed questions to determine the object that the knowledge engineer has in mind. This technique is used to give insights into expert problem-solving techniques. This requires a high level of background knowledge	[1][3][5][9]
Document analysis	This technique consists of analyzing document taking courses to gain knowledge of the domain. It is recommended to commence the pursuit of knowledge with this technique as little background knowledge is required and much can be gained.	[2][6][9]
Protocol analysis	This technique consists of an expert performing a task while they are describing simultaneously or post-activity what they're doing, why, or what they could have done. This can be used for normal but also extraordinary tasks or cases. Some background knowledge is required.	[1][2][3][5] [7][8][9]
Commentary or thinking out loud	This technique consists of an expert thinking out loud or running commentary while or after executing an activity or task. The main objective is self-report. The knowledge engineer can ask questions but is not obliged to. The level of background knowledge depends on the task.	[2][3][5][8]
Observation	This technique consists of observing the expert whilst they perform their daily tasks and activities and deduces which knowledge the expert is using. This technique requires background knowledge as well as experience [x] found that inexperienced knowledge engineers experience hardship interpreting observations.	[1][3][4][5] [8][9]
Teach-back technique	In this technique, the knowledge engineer offers the expert the knowledge they have gathered, while the expert comments on, adjust or adds the given knowledge. High background knowledge is required.	[3][5][8]
Laddering techniques	This bundle of techniques consists of creating a hierarchy of the gathered knowledge, and reviewing, modifying and validating it together with an expert. These techniques focus on discussing, validating and modifying knowledge, as opposed to gathering it.	[1][3][5][6] [7][8]

Matrix-based techniques	This bundle of techniques is focused on the creation of grids/matrices. This involves the construction of grids indicating such things as problems encountered against possible solutions.	[3][5][7][8] [9]
Sorting techniques	This bundle of techniques is focused on ordering the capture data e.g. card sorting. It is used for constructing a structure of the domain.	[1][2][3][5] [7][8][9]

[1] Dieste & Juristo (2010)

[6] Rao et al. (2008)

[2] Hoffman et al. (1995)

[7] Schreiber et al. (2000)

[3] Akhavan et al. (2011)

[8] Shadbolt et al. (2015)

[4] Mohammed& Al Saiyd (2010)

[9] Welbank (1990)

[5] Nezafati et al. (2007)

The CommonKADS knowledge elicitation techniques can also be found in Table 1. CommonKADS is a widespread methodology, and the most influential academic method in knowledge engineering to date (Zacharias, 2009). Schreiber et al (2000) argue to do it in a structured way, in other words, not just haphazardly use a random technique, but different techniques should be applied in different scenarios. They also argue that there are different types of experts namely, the academic type, the practitioner class, and the samurai. The first being the expert that aims to generalize their domain, theoretical understanding is favored (Schreiber et al., 2000). The practitioner class is more operational and constantly engaged in day-to-day problems and theorems are not the highlight in their eyes. The last expert is a pure performance-focused; practice makes perfect. The nature and way of working of these experts should not be ignored, according to Schreiber et al. (2000), as they differ in how they will react to certain elicitation techniques as well have different information to offer.

As mentioned before, there are automatic techniques that could aid the process of ontology development, such as OntoGain, OntoLearn, ASIUM, etc. However, due to the nature of the ontology, as well as the nature of the knowledge, which is explained in 4.5.3, “Types of ontologies”, semi-automatic tools won’t serve their benefit within this research. Therefore, these tools are omitted at this stage of the process.

4.3. Ontology Editors

As mentioned before, creating an ontology can be done through several methodologies, manual or semiautomatic. But the final step in the ontology building process is building it, in a program for it to be usable. These programs are called ontology editors, are “tools that enable inspecting, browsing, codifying, and modifying ontologies and support in this way the ontology development and maintenance task” (Stojanovic & Motik, 2002). These editors do not merely associate with creating an ontology, these programs are also able to execute corrective maintenance, adaptive maintenance, perfective and preventive maintenance (Stojanovic & Motik, 2002). There are several editors out there, all with different methods of working as well as advantages and disadvantages. W3C offers several options in ontology editors to build one’s own ontology, which are the following: Protégé, NeOn Toolkit, SWOOP, Neologism, TopBraid Composer, Vitro, Knoodl, Anzo for Excel, OWLGrEd, Fluent Editor, Semantic Turkey, & VocBench.

The first editors, Protégé, is the most used editors and very pluggable into different software (W3C, 2009), user-friendly (Stojanovic & Motik, 2002), and carries the highest percentages of recommendations according to a study by Siricharoen (2018). Furthermore, this editor is a free, open-sourced program and is highly scalable and extensible (Alatrish, 2013). NeOn Toolkit is an editor with also many plugins available, but often used for heavy-weight projects (W3C, 2015), and ranks poorly amongst recommendations, merely 3.03% recommends NeOn Toolkit (Siricharoen, 2018). SWOOP is an ontology editor that demands one to learn a specific software language, is described by W3C as “a small and simple ontology editor”, and, similarly to NeOn Toolkit, ranks poorly in recommendation rankings, 3.03% (Siricharoen, 2018). Furthermore, SWOOP ranks poorly among the comparison of usability of tools, inference services, and interoperability according to Alatrish (2013). TopBraid Composer has the highest ranking next to Protégé with a 9.09% and is described as a multi-purpose editor (W3C, 2015), and where the previous editors were open-sourced, is this a licensed software. In a comparison by Alatrish (2013), TopBraid Composer excels in areas e.g. interoperability and inference services. The other editors presented by W3C, e.g. Neologism, Vitro, Knoodl, Anzo for Excel, etc., are not thoroughly discussed on any platform, therefore they will not be taken into account for this research.

4.4. Evaluation Methods

Once an ontology is built, it needs to be evaluated whether it is appropriate and qualitative adequate. There are several ways of evaluating an ontology and it can be done on several aspects. Asim et al. (2018), Brank et al. (2005), Dellschaft & Staab (2008), Hlomani & Stacey (2014) and Raad & Cruz (2015) all offer the same approach to evaluation related to the layers of an ontology, see Figure 5.

Level	Approach to evaluation			
	Gold Standard	Application-based	Data-driven	User-based
Lexical, vocabulary, concept, data	X	X	X	X
Hierarchy, taxonomy	X	X	X	X
Other semantic relations	X	X	X	X
Context, application		X		X
Syntactic	X			X
Structure, architecture, design				X

Figure 5: Approaches to Evaluation (Hlomani & Stacey, 2014)

There are four main strategies on how to evaluate ontologies according to the mentioned academics. Gold standard is the comparison to a “golden standard” (Brank et al., 2005) and “are also known as ontology mapping or ontology alignment” (Asim et al., 2018). The difficulty within this task, as suggested by Asim et al. (2018), is to find an ontology that has been created with identical or comparable circumstances and goals as the created ontology. This type of evaluation does cover a grant part of the layers of the ontology, however, the reason of the creation for the special cargo sector is the fact that there is not one publicly available. Therefore, this method cannot evaluate the ontology if there is no counterpart or gold standard to compare the created ontology to.

Another method of evaluating the artifact is its functionality in the application it will be used (Brank et al., 2005). This technique also called ‘Task-Based Evaluation’ (Asim et al., 2018). Commonly, an ontology is built for a task, use-case scenario or application of a sort, either technical or operational. Thus, Brank et al. argue that a proper ontology supports the application to produce appropriate results in the task at hand. The simple version is that one plugs the ontology into the application and evaluates the results of the application. It has to be considered that the ontology may only be a small percentage of the application thus might not

have a significant effect, as well as that it's hard to generalize the observation of the quality of the ontology.

Next, the data-driven evaluation is offered as an approach to assess the result, which can also be called Corpus-based evaluation (Asim et al., 2018). This approach uses textual corpora to determine the coverage of the ontology within a specific domain. The main advantage is that it can be used to compare one or more target ontologies, to a specific corpus which is much easier to find than an ontology of the same domain. However, this is often used to pick the most accurate ontology, instead of evaluating merely one ontology.

The final approach to evaluation is the user-based or assessment by humans. Although this can be defined in multiple ways, e.g. assessments among different ontologies (Asim et al., 2018), assessments based on user experience (Hlomani & Stacey, 2014), or assessments by humans on "how well the ontology meets a set of predefined criteria, standards, requirements, etc" (Brank et al., 2005). The general human-based assessment is the most subjective evaluation but also the most accessible.

Finally, it is important to determine which criteria will be evaluated the ontology. Different criteria can be targeted. Based on the framework Hlomani & Stacey (2014), the criteria in Table 2 were selected as appropriate to validate an ontology-based on this view.

Table 2: Definition of Evaluation Terms (Hlomani & Stacey, 2014)

Term	Definition
Accuracy	The criteria for determining if the asserted knowledge in the ontology agrees with the expert's knowledge about the domain. A higher accuracy will typically result from correct definitions and descriptions of classes, properties, and individuals.
Adaptability	Measures the ease of use of an ontology in different contexts possibly by allowing it to be extended and specialized monotonically, i.e. without the need to remove axioms
Clarity	Measures how effectively the ontology communicates the intended meaning of the defined terms
Cohesion	From an ontology point of view, cohesion refers to the relatedness of elements in ontologies. It is intended to measure modularity. An ontology would have

	high cohesion if its classes are strongly related therefore, high cohesion is a desirable property.
Completeness	Measures if the domain of interest is appropriately covered. All questions the ontology should be able to answer can be answered.
Computational efficiency	Relates to the speed at which tools can work with the ontology (e.g. reasoners)
Conciseness	Intended to reflect if the ontology defines irrelevant elements with regards to the domain to be covered or redundant representations of the semantics.
Consistency	Describes that the ontology does not include or allow for any contradictions.
Coupling	Reflects the number of classes from imported ontologies that are referenced in the ontology.
Coverage	Reflects how well the ontology represents the domain it models.

Certain techniques or tools do not consider all criteria, e.g. a use-case scenario evaluation doesn't consider computation efficiency, multiple methods will be considered in the evaluation of these criteria as the guidelines of the validation of the ontology. It must be noted that similarly to the notion that there is no 'correct way to model a domain' (Noy & McGuinness (2001), it can also be applied to evaluation. Each ontology is different, constructed differently and has the influence of the creative process of the individual who created the ontology, which might not fully comply with the structure others have in mind. Specifically, the bias of humans within a human-based assessment can differ with each individual. The validation is crucial nonetheless, as the ontology offers consensus within the domain.

5. Methodology Design

5.1. Methodology Base and Tools

In the previous chapter, several methodologies were briefly discussed alongside their advantages and disadvantages. Based on the compatibility with the life cycle, details, and conformity to the objective of this thesis, the methodologies will be assessed.

The first two methodologies were discussed as they were fundamental within the ontology engineering research field. However, they seem unfit as they are focused on business modeling and severely lack in technique and details. Therefore, the Enterprise Ontology by Ushold and King (1995) and the TOVE by Grüninger and Fox (1996) are not fit for this study. Another methodology that seems unfit for the study is the methodology suggested by Seremeti & Kameas (2009). While they discuss different angles, none of them elaborate on details, nor do they discuss the steps in a thorough matter. Therefore, Seremeti & Kameas (2009) does also not fit. While OTKM (Sure et al., 2004) does entail proper details the application dependency on knowledge management, does not align with the application within this study. As it emphasizes on this application, this methodology does not comply with the objective of this study.

After these eliminations, there are three methodologies left that decently comply with the objective of this thesis, namely the 101 method, UPON and METHONTOLOGY. First off, as mentioned in an analysis of ontology engineering methodologies, these last three are comparable in many aspects in that they all “follow an evolving prototype model, their natures are application-independent and provide at least some details about the techniques and activities they employ” (Iqbal et al., 2013). The 101 method by Noy and McGuiness (2001) is specifically very detailed in the last stages of the methodology. If the chosen ontology would be Protégé, this guide would give clear instructions and visuals in the implementation into the editor. Yet, the 101 method can be perceived as fairly basic compared to the other two, as it brands itself as a simple knowledge engineering methodology. METHONTOLOGY however, does entail sufficient details throughout the methodology according to Iqbal et al. (2013), where others only offer some. This methodology, however, is the oldest out of three, but also considered the most mature and elaborate one (Corcho et al., 2003). UPON is the youngest among these three, and as mentioned by De Nicola, Missikoff and Navigli (2005), follows roughly the same development process as METHONTOLOGY. The approach that UPON

takes on developing an ontology, based on software development, on top of the iterative nature and customizability may offer a greater possibility of success.

As mentioned before, an existent methodology will be used as a baseline and will be augmented and adjusted with KE techniques to fit the purpose of this study. The UPON methodology will be used as a guideline. As mentioned in section 5.2, there are several techniques, as well as different experts that they can be applied to. The most prominent present experts within the field of special cargo are the practitioner and the academic, as they are either in an operational function, executing practical bookings, or the experts are in a managerial function, aiming to create and optimize solutions within the special cargo sector. A possibility as well is that the expert is a combination of these two types of experts.

To eliminate the knowledge acquisition techniques that won't fully serve the purpose of extracting knowledge within the special cargo field, is the starting point. First off, a mandatory technique within the field of special cargo is document analysis, to extract the bare minimum of background knowledge to execute other knowledge acquisition techniques. Secondly, Dieste and Juristo (2010) argue that introspective techniques such as protocol analysis, observation, and commentary or thinking out loud are rated the worst techniques in all tested dimensions (effectiveness, efficiency, completeness), thus these will be eliminated from the possible KE methods. Furthermore, they also empirically proved that the laddering technique is favored over sorting techniques. Finally, unstructured as well as structured interviews are preferred in terms of effectiveness and completeness but laddering in terms of efficiency. Another technique that could be considered is twenty questions. This technique is different in the interviewing approach it takes, but is interchangeable with laddering, as both aim to extract order within knowledge. Furthermore, the matrix-based techniques, such as the repertory grid technique, according to Dieste & Juristo (2010) should be minimally be used, as it doesn't offer the benefits as interviewing does. Finally, the teach-back method, where knowledge of the knowledge engineer is reflected by an expert, will also be used in this study, as it's important that knowledge is extracted but is also correct. This technique will aid to that goal. However, as time and resources are scarily available, this technique will be incorporated within the structured interviews.

Thus, unstructured as well as structured interviewing including teach-back, laddering, document analysis will be used in this methodology.

For the academical type of expert, with their structured view of knowledge, the main task is to have the knowledge in writing, as the expert already has an organized view of their knowledge. For this type of expert, structured as well as unstructured interviews will be conducted, alongside the teach-back method. For the practitioner, where there is a lot of practical knowledge but not necessarily structured, it is crucial that an adequate amount of knowledge is extracted. Therefore, unstructured but primarily structured interviews will be conducted. Furthermore, laddering techniques will be applied to extract (missing) concepts.

Lastly, due to the pluggability, long threshold and customizability as well as the study of Siricharoen (2018), the chosen ontology editor is Protégé. This editor supports RDF as well as OWL.

5.2. Evaluation Techniques

Different methods of evaluation were discussed in section 5.4, however not every technique is appropriate for the created ontology. There are several aspects to be taken into consideration when choosing an evaluation method, but the challenge remains which one is most appropriate. A reoccurring case is that an ontology is evaluated amongst others to find which one is ‘most correct’. The ontology of this study has a primary goal, to structure the information of the special cargo, as it is currently unstructured and non-transparent. This implies that currently, there is little to no structure publicly available. Thus, choosing the most correct one where there is only one ontology, is not viable. A gold standard is therefore not compatible.

Second, due to the juvenility of the LARA project, there is no software or technical application that can be used as evaluation, thus eliminating the application-based evaluation based on a technical application. However, there are still different tasks, different cases in which the ontology can be evaluated based on if it’s able to execute tasks as well as deliver appropriate answers. While task-based evaluation can be based on queries, the query language falls out of the scope of the thesis, therefore this will not be a possibility. Yet, it is possible to combine a task-based evaluation with a data-driven evaluation. This technique, data-driven evaluation based on a corpus, is executed through NLP. Whilst this technique addresses the functionality of an ontology through an objective lens, and a corpus has been built in the objective of the LARA project, NLP does not lie within the scope of this research. However, if the annotation of the corpus is done manually, based on tasks, this combines both techniques in a manual matter, and offers an evaluation method based on completeness, coverage, and accuracy, in a

semi-objective manner. This technique will be further referred to as the evaluation of the ontology.

The final technique, user-based or human-based evaluation, can be executed in multiple ways as mentioned before. The goal of a user-based evaluation isn't assessing consistency or semantic correctness, but more the subjective information of the ontology which Supekar (2005) values as equally important. As mentioned by multiple academics (Brank et al., 2005; Vrandečić, 2009), the assessment by humans can be done by evaluating how an ontology meets a set of predefined criteria and requirements. A set of predefined requirements, or rather principles, can be found in section 3.5. Another method of human assessment is the method of the capability of the ontology to answering predefined competency questions (De Nicola et al., 2005; Vrandečić, 2009). As constructing competency questions is part of the chosen UPON methodology, this method of assessment will also be taken into consideration. So, the components the ontology will be assessed on will be principles and competency questions. The next question lies in who will do the assessment, and how these aspects will be measured. The competency questions will be done based on the drafted competency questions based on the ontology methodology and evaluated by a domain expert in cooperation with the ontology engineer. The principles assessment will also be performed by the ontology engineer in combination with a domain expert. The human-based assessment will be further referred to as the assessment of the ontology.

To finalize the evaluation methods, accuracy, adaptability, clarity, conciseness, and usability will be reviewed by the assessment. Completeness, coverage, and accuracy will be evaluated by task-based evaluation. Computational efficiency will be evaluated by the build-in reasoner of Protégé. As will be discussed in the following chapter, the chosen UPON methodology also offers its own approach to ‘testing’ the ontology. The above-mentioned techniques will be adjustments to the methodology.

5.3. Methodology

UPON follows the UP, the unified process, which results that the methodology consists of cycles, phases, iterations, and workflows as seen in Figure 6.

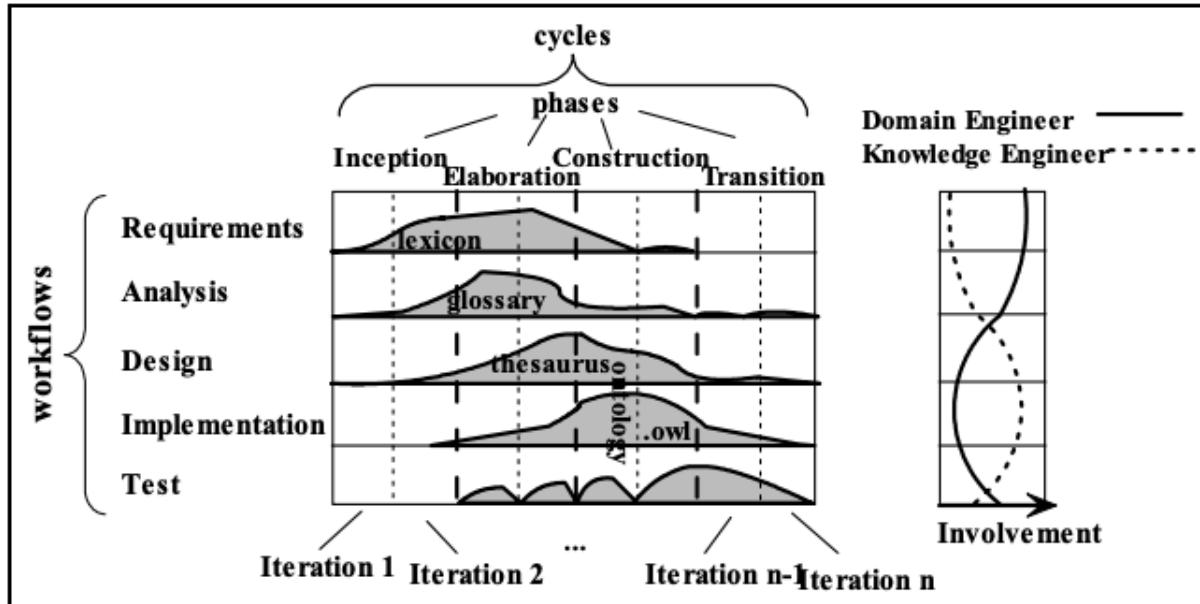


Figure 6: the UPON Framework (De Nicola et al., 2005)

In short, the UPON follows the following order: the first iterations predominantly regard the capture of requirements and the beginning stages of performing conceptual analysis. Ensuing this stage, the elaboration phase is initiated which concerns the analysis workflow, which includes the identification and structuring of the vital concepts. The following construction phase entails the design and implementation of iterations. In the final phase, the transition phase, the iterations are focused on testing and the eventual release. As can be deducted from Figure 6, the first iterations will deliver a lexicon that will be elaborated upon until the ontology is complete with its enriched definitions and relations.

Requirement workflow

The requirement workflow goal is to identify the objectives of the ontology users, which consists of “(i) determining the domain of interest and the scope, and (ii) defining the purpose” (De Nicola et al., 2005). These objectives can be achieved through several methods, UPON mentions writing a storyboard in order to extract the terminology from the domain expert and creating competency questions, however in the relevant domain, this step is relatively more substantial. Therefore, in this phase, the knowledge engineering techniques will be applied

according to the CommonKADS method on top of the UPON techniques. The knowledge elicitation will transpire in three phases namely, knowledge identification, knowledge specification, and knowledge refinement. In the first phase, the unstructured interviews alongside document analysis will be implemented to identify the knowledge. In the next phase, knowledge will be specified through structured interviews alongside with laddering and the teach-back method. In the last phase, refinement consists of applying instances and validating the model, this is not within the scope of this research, and therefore will be disregarded.

To fulfil the two objectives of this workflow, an ORS (ontology requirement specification) document will be drawn up. The document (Suárez-Figueroa et al., 2009) entails the activities of collecting the requirement the ontology needs to adhere to. This document is part of the compilation of the requirement workflow. Together with the ORS document including the competency questions, an application lexicon and a use-case model will be the outcome of this workflow. In the formal methodology, the application lexicon is created through the usage of semi-automatic tools, however, due to the manual nature of this study, this application lexicon will merely exist of expert knowledge. This requirement workflow fades into the next phases, which aims to refine and structure. The KE techniques will have acquired the knowledge and will have as aim to identify and analyze the relevant terms, which is equivalently the objective of the second phase.

Analysis Workflow

The analysis workflow goal is to refine and structure the identified requirements of the previous step. This includes the following steps, considering reuse of existing resources, modeling the application scenario using UML diagrams, and building the glossary. Considering the reuse of existing resources also entails the assessment of other domain ontologies. This means that if they cannot be implemented, what the relation is with the ontology, e.g. the built ontology covers a different task but can be implemented in the assessed ontology. The UML diagram will be the result of the laddering technique.

Design Workflow

The design workflow goal is to refine the entities, actors, and processes identified in the previous workflow, additional to the identifications of their relationships. The steps within this stage inhabit, categorizing the concepts according to the OPAL methodology, refining the

concepts and their relations. OPAL (Missikoff & Taglino, 2002) is organized into three primary modeling aspects: Actor, Processes, and Object.

Implementation Workflow

The implementation workflow goal is to have the ontology formalized in a language and implemented with regard to its components. The results of this workflow will be the ontology and will be incorporated within this study as visualizations and statistics on the e.g. the number of axioms.

Test Workflow

The test and final, workflow goal is to evaluate and authenticate the ontology and its components and requirements. As mentioned in section 6.2, this evaluation will be done based on human-based assessment and a task-based evaluation.

Human-based Assessment

As mentioned before, the assessment has two tracks, the competency questions and the principles assessment. The competency questions (CQ) are drafted in the requirement workflow, as the manual assessment will be based on the CQChecker module of Bezerra et al. (2013), which is as follows:

1. Split the CQ in tokens
2. Find among the tokens of the CQ the main concept (class)
3. Find in the given CQ the main property which the main concept is related to
4. Find if the concept and property, also known as an axiom, are connected
5. Identify the type of axiom
6. Identify the return of the axiom
7. Check if the type and return of the axiom are correct

The principle assessment is a subjective tool, which requires the collaboration of the ontology engineer and a domain expert. Each of the guidelines will be discussed and will receive one of the following ratings: ‘non-compliant’, ‘not fully compliant’, and ‘compliant’ with support on why this rating was chosen. The ontology will have knowledge concerning the ontology as this person will have created the artifact, however, the domain expert will not. To transfer the content of the ontology as accurately as possible, a case study will be collected from the domain

expert. This case will then be converted into ontology related terms and relations and discussed with the domain expert. This will be the base of the assessment by the domain expert.

Task-based, Data-Driven Evaluation

The evaluation, which is a combination of task-based and data-driven evaluation, will be conducted by a domain expert. The manual annotation will be conducted as follows:

1. A corpus concerning the planning phase of special cargo is created by a fellow LARA researcher. This LARA researcher will randomly pick 20 documents to be annotated.
2. A domain expert will annotate these documents manually
3. The ontology engineer will receive the annotated document and will enumerate from the document what the important entities are to be cross-checked with the ontology
4. The assessment will be done by the similar to the competency questions assessment, and will be graded ‘non-compliant’, ‘not fully compliant’, and ‘compliant’ with support on why this rating was chosen.
5. Highlights of the assessment will be discussed, and a general score will be given.

The final step in the testing phase is to adjust the ontology according to the result of the overall evaluation.

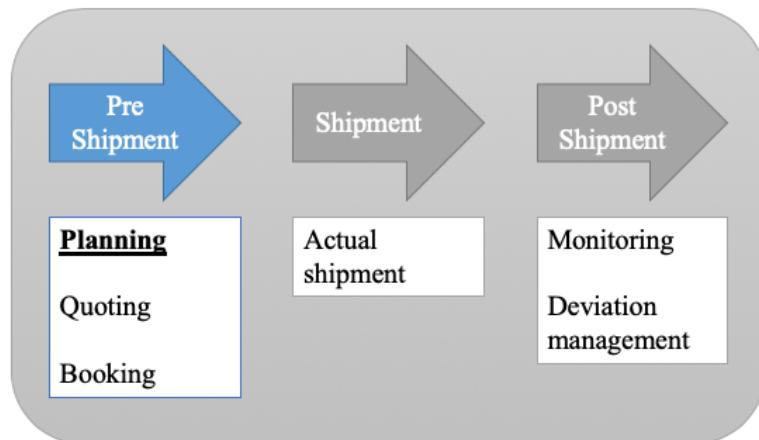
6. Implementation

6.1. Requirement Workflow

The domain of interest of this ontology is the special cargo industry, with a focus on airfreight. The scope of the ontology consists of the identifications of the ontological commitments of the planning phase of this sector. This concerns all the processes and products that cover the interactions of special cargo airfreight forwarding within the planning phase of a shipment. In Figure 7, the general sketch of these components can be found. The cargo that requires special handling is divided into multiple segments, namely, Pharma, Dangerous Goods, Perishables, Live Animals, and High Value. The main purpose of this ontology is to structure and digitalize the special cargo sector with a focus on airfreight. More specifically, the determination of available choice set for routing options including specific product features and capabilities and services or air carriers and ground handling agents. This information can also be found in the ORS document in Appendix A. Alongside this document, the initial application lexicon was constructed. This can be found in Appendix F, which is based on the KE techniques, which will be elaborated upon in the next section. The lexicon is incorporated with the OPAL justification appendix. The final step in the requirement workflow is to applying use-case models based on the competency questions. The visualization of this use-case can be found in Appendix B. The packaging, or grouping, and prioritizing of competences according to the use-case can also be found in A, section 5c.

6.1.1. Knowledge Engineering Techniques

Figure 7: Scope of Ontology



As mentioned in the elaborate requirement step, there are three phases to follow and all have their appropriate techniques. In the first step, knowledge identification consists of unstructured

interviews and document analysis. Validaide was the starting point of this phase. As a company that serves multiple stakeholders within the planning phase of special cargo, and is the first part of this research, this is where the knowledge initially will be elicited. The documents to be analyzed were provided by Validaide, along with retrieval of documents through searching machines, these documents can be found in the references as they are referred to in this research. As no academic goes into detail on how to perform a proper analysis of documents, reoccurring concepts were extracted. Unstructured interviews were held within Validaide and the base of the background was laid.

The next phase is the specification of knowledge, with structured interviews. Based on the background knowledge acquired, there are four fields of experts; freight forwarders, shippers, ground handling agents and support experts. While shippers play a vital role in the transportation of special cargo, as it's their goods that are being shipped, they don't play a vital role in the booking of special cargo. Freight forwarders book and arrange the shipments, based on the user requirements they request from their shippers; therefore, shipper experts won't be consulted. Furthermore, due to resource and time constraints, ground handling agents will also not be consulted. The interviews were based on CommonKADS and its guidelines and examples of conducting an interview. The base of each interview can be found in Appendix C, the transcribed and summary of each interview of different experts can be found in Appendix D.

Laddering was conducted with a support expert, and the result can be found in Appendix E. As mentioned in section 6.3, the laddering technique will be conducted to elicit the UML diagram, thus formally falls into the analysis workflow.

6.2. Analysis Workflow

Existing resources or ontology have been acquired through a thorough search of several Ontology Libraries (OL), based on the research of D'Aquin and Noy (2012) i.e. W3C, DAML, TONES, SHOE, OntoHub, ONKI and file search owl within search engines. The following ontologies were assessed to the relevance to the domain of the built ontology; IATA – ONE Record, The NASA Air Traffic Management Ontology, and the Air Travel Booking Ontology. However, the conclusion could be drawn that these ontologies are not to be implemented but to be collaborated with, for different tasks.

The IATA ontology is elaborate in concepts, yet there are no object or data properties implemented. However, the task application of the ONE Record differs from the Special Cargo Ontology of this study. It aims to be a standard for data sharing, e.g. be implemented in a message system, whereas Special Cargo Ontology aims to be a standard for routing options, capabilities and products. They are used in different stages of the process, i.e. Planning vs Booking and (post) Shipment. The results, the chosen product, airlines, etc. of the Special Cargo Ontology can be implemented into ONE Record.

The NASA Air Traffic Management (ATM) Ontology is a highly sophisticated ontology concerning air traffic management. The ontology goes into detail of aircraft e.g. aircraft type, engine type, weight class, etc. Whilst highly detailed, similar to ONE Record, the task isn't compatible, and the domain is slightly shifted, as NASA does not go into (special) cargo but focuses on air traffic. The Special Cargo Ontology could implement the ATM in future applications e.g. aircraft models as capacity guidelines. As mentioned by Vrandečić (2009), within the context of the Semantic Web, often ontologies may be used in ways unexpected by the original creators of the ontology.

Finally, the Air Travel Booking Ontology, created by Chaohai Ding, is for an air travel booking service and presents information about the scheduled flights. It is not as broad and detailed as NASA yet offers a clear structure into the domain of passenger flights. This, however, does not comply with the Cargo specification of this study's domain. They did apply instances to e.g. nine instances to the concept of Airports. However, this does not fully cover all airports, thus still needs to be augmented. Thus, this ontology does not offer significant benefits to be implemented or associated with the Special Cargo Domain, as the only overlap is 'air transport'.

The next step is to model the application scenario based on the drafted UML use-case diagram, in the form of a simple UML class diagram. This can be found in Appendix E, as the result of the elicitation technique laddering. The final step in the analysis workflow is to build the first version of the glossary concerning the concepts of the domain, which will merge the application lexicon and the domain lexicon. These can be found in column 'concept', 'subclass', and 'sub-sub' of Appendix F.

6.3. Design Workflow

In Appendix F, you will find the identification of the OPAL methodology, as well as a justification of why this entity should be in the ontology. The subclasses are related to the main class through a ‘kind-of’ or an ‘is-a’ relation. When a ‘part-of’ is defined, this can be found in column ‘notes’. The object and data properties can be found in the ontology, with its’ explanation in Appendix G. Noteworthy concepts that could require a thorough explanation are the following:

- *The attributes acceptance time, delivery time, connection time and transit time:* These attributes are important to the ontology as e.g. a shorter delivery time can be a need a shipper has. Despite that these times can be capabilities where one solution is preferred over another, they do not affect other concepts in a major way and are rather aspects of a solution than an object or class.
- *Tarmac, to incorporate it or not:* the tarmac is where most temperature excursion takes place, and therefore lies the highest level of risk, but is not always referred to in product or services or airlines, due to marketing reasons, i.e. one is not going to advertise how much more risk a certain product has. But it is vital to structure reality, therefore tarmac is incorporated into the ontology.
- *Solutions and Capability:* these two concepts are tightly intertwined, but simultaneously critically different. Solutions are built on the capabilities an airline and its GHAs can offer. However, not every capability is offered at every location, but solutions are a general offering, but also linked to a certain location which complicates the structure of these concepts. To increase clarity, two are separate concepts.
- *Type of Capabilities:* in the ontology, several capabilities subclasses are linked to a certain type of good e.g. speeds capabilities, but one distinct class is the GHA capabilities. This differentiation is made because the other capabilities are not necessarily executed by the GHA, but can also be executed by the airline themselves. Therefore, by making a distinctive class for GHA, it is clear these capabilities are executed by GHA.
- *Route, leg, and flights:* the main objective of the ontology is to collect and structure knowledge about cargo services. This does not directly imply that routing is a vital part of the ontology. However, as mentioned above, not all capabilities are offered at all stations. To know which services and solutions are available for the shipment, the to be taken route must be considered.

- *The SPH codes*: the special handling codes are currently the most centralized method of designating and identifying shipments. However, the main purpose of these codes is to instruct people on how to handle a certain shipment. This does not interact with the choice set of solutions. But these codes inform the handler what is inside of the shipment. If this can be transferred to a certain solution, this would be valuable for the shipper as well as other parties involved as a quicker overview can be made.
- *Transport*: despite the ontology's focus on airfreight, multiple types of transport have been incorporated. First, because this will make the extension of the ontology into other domains easier, and second, because often an airfreight shipment is not merely flight, it involves trucking.
- *Shipment versus Characteristics*: a challenge arose in where to place the characteristics of shipments. First, they were placed as a sub-domain of shipment. However, the 'kind-of' relation of a domain with its subclasses, does not uphold with shipment and characteristics. The characteristics are aspects and could be argued to be (data) properties rather than separate classes. The reason why these aspects are integrated as classes is due to the significant role it places in the choices of products.
- *Solution and Commodities*: these subdomains of these two classes are eerily similar, so the question remains why they are not the same. This is due to the approach airlines are taking in naming and designating products. E.g. The active Celsius product of Swiss Cargo does not merely cover pharma, it also covers perishables. Due to this difference, the ontology separated these two domains but did connect them.
- *The choice between property or concept, such as operation days*: as previously mentioned, there are choices to be made to make an attribute a property or concept/class. The primary consideration is the effect on the possible solution and routing option. Secondly, an attribute is reviewed whether or not they influence other concepts within the ontology and finally, the question is asked whether or not it offers any (future) value to the ontology.
- *Packaging as part of capabilities or not*: packaging was a tough concept to place, as this is not always a necessary part of a solution, because it can also be already provided by the shipper itself, but it does affect routing as well as solutions. Therefore, this concept was integrated as a 'main class' or rather a subclass or owl:Thing, and is linked through relations with solutions, shippers, freight forwarders.
- *Container as part of packaging or not*: As many experts often mentioned, containers are not part of packaging, as a shipment isn't 'packed' into a container. However, containers have similar goals to packaging and affect risk the same way as packaging does, i.e.

minimizing the effect ambient temperature has on the shipment. Therefore, container has been placed as a subdomain of packaging.

- *Risk and its types*: risk is a very important concept within the special cargo industry. Risk is why certain shipments require special handling, to minimize the risk and try to guarantee the quality of the products. However, modeling this into this ontology was an onerous task, as risk is usually based on a complicated algorithm. In this ontology, risk is simplified, as different types that interfere with the quality of a shipment. It should be seen as a simplified base that should be elaborated upon.
- *Shipment and booking and its correlation*: in the current ontology, booking is modeled as a sub-domain of shipment. Whilst booking is not directly seen as ‘booking is a ‘kind-of’ shipment’, it is compatible as a sub-domain within the ontology. Booking combines all the aspects of a shipment, with those from the chosen solution. Therefore, shipment is the overarching domain, and booking adds aspects to this.
- *Capacity*: The uncertainty of implementing this concept and how to implement laid in the fact that factors such as overcapacity, limited capacity for dangerous goods, priority booked capacity can make one solution more attractive over others. However, the actual information on capacity is often not given out, merely that there is priority boarding. But this information could in the future possibly become available, therefore it is implemented as an attribute/data property.
- *Exposure Time*: This concept or attribute was hard to categorize. Exposure time in its essence is an attribute of how long a shipment will be exposed to ambient temperatures. However, it could influence risk, but then it’s hard to apply an exact exposure time to the shipment. Therefore, it was chosen to make exposure time an attribute/property. If in the usage of the ontology this does not qualify, this can be augmented.
- *Relations from solutions to capabilities*: The capabilities of an airline and ground handlers are fundamental and required for the execution of certain services. But modeling it simply as a solution requires capabilities is too general, as this is one of the fundamental relations. Therefore, some are coded as <concept>isPackedIn<packaging>. This might implicate an encoding bias but does eliminate generalization.

The following concepts were not implemented:

- *Documentation - e-AWB/SOPs*: despite that the special cargo industry requires a lot of paperwork, and that it’s vital this is done correctly, this does not influence or affect the choice on which route or solution should be taken. The IATA ontology does consider these

aspects, as documentation is the main goal of this ontology. So, if documentation is a concept the ontology in future regard could be elaborated upon, this can be done through the IATA ontology.

- *Fleet*: this concept was first implemented to the ontology, as it could indicate the capacity a certain type of aircraft could hold. However, as mentioned, capacity is implemented as an attribute, and this information isn't publicly linked to solutions. Fleet could also play a role in sustainability i.e. CO₂ emissions of certain fleet. However, this isn't the main task of the ontology. Therefore it is omitted.
- *Weather*: this concept was first implemented into the ontology as the weather could affect risk in various ways. However, the crucial component is temperature, and weather in itself is too vague as the weather has multiple aspects and sides. Therefore, this concept is omitted for now, and perhaps can play a role in the future, when it is made abstract.
- *Import/export*: these concepts could play a role in the execution of the solutions, as import executes differently than export e.g. import requires more information on delivery times as opposed to export that requires information on minimum acceptance time. However, this distinction rarely is considered by airlines or freight forwarders. Therefore, this won't be implemented.
- *Augmented solutions*: the difficult task of booking a shipment is that currently there is no overview or structure into which solution offer which benefits and where these benefits apply. This is where this ontology comes in. An impossible task is to structure solutions and services that do not exist, i.e. a rare shipment that requires a solution that is augmented. Therefore, this is omitted in this ontology.
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6.4. Implementation Workflow

As indicated in section 6.1, the ontology is built in Protégé, and written in RDF and OWL (Ontology Web Language). The metrics can be found in Table 3. Visualization of the ontology can be found in Appendix J.

Table 3: Ontology Metrics

Metric	Amount
Axiom	724

Logical axiom count	344
Declaration axiom count	197
Class count	129
Object property count	43
Data property count	20
Individual count	7
Annotation property count	4
Class axiom	<ul style="list-style-type: none"> - SubClassOf - 240 - DisjointClasses - 14
Object property axioms	<ul style="list-style-type: none"> - SubObjectPropertyOf - 2 - InverserObjectProperties - 5 - FunctionalObjectProperty - 8 - TransitiveObjectProperty - 4 - ObjectPropertyDomain - 4 - ObjectPropertyRange - 3
Data property axioms	<ul style="list-style-type: none"> - FunctionalDataProperty - 4 - DataPropertyDomain - 25 - DataPropertyRange - 19
Individual axioms	<ul style="list-style-type: none"> - ClassAssertion - 16
Annotation axiom	<ul style="list-style-type: none"> - AnnotationAssertion - 183

6.5. Test Workflow

This workflow is also known as assessment and evaluation.

Assessment of Ontology

This two-part assessment, Competence Questions and Principles, can be found in Appendix H and Table 4 respectively. The Competence Questions assessment was executed manually. In Table 4, a fragment of this assessment can be found. The question is answered in how it would be represented in real life as well as the ontology, and the compliancy evaluates if these answers are coherent, and the relationship is the concepts and relationships it adheres to in the ontology. In both Appendix H and Table 4, ‘semi’ compliance can be encountered. This semi compliance can either mean that due to the lack of appliance of instance, this question cannot be fully answered. Or it can mean that it is implied, but there is no direct relation between these concepts. The main findings of this evaluation are that certain capabilities should be further defined. Furthermore, applying instances would give a clearer answer to the questions and finally, ‘Does exposure time influence temperature risk?’ is the only question that couldn’t be (partly) answered. But as discussed in 7.3., exposure time was omitted as a singular concept. However, if in future regards this concept deems vital in the ontology, this should be adjusted.

Table 4: Fragment of Competence Question assessment

Question	Real-life answer	Ontology answer	Compliance and relation
Does a pharma solution have a booked temperature range?	Yes	Yes	YES: Temperature Controlled Solutions ‘has temperature range’ <i>some</i> Booked Temperature Range
Does lithium batteries transport have restrictions?	Yes	Not fully deductible	SEMI: Dangerous Goods Class ‘has maximum capacity’ (classes are not populated yet)

In Table 5, the Principle assessment can be found. As mentioned, the base of the assessment of the domain expert is a case study, which can be found in Appendix K. In short, this case contains a pharma shipment with a passive packaging that has a route from Gembloux, Belgium

to BKK, Bangkok. The aim is to extract the mentioned and relevant concepts and their correlating relations to communicate the ontology to the expert. This can be found in part 2 of Appendix K. In this assessment, you can find some adjusted and added concepts and relations as a result of the case study. This case accounted for the explanation of the ontology. Based on this, and with cooperation with the ontology engineer, the principles were assessed, as can be found in Table 5. The highlights of the assessment lie within the principles that are non-compliant. The non-compliance is bound to the lack of application, as it's hard to measure if there is a greater efficiency or usability if the design cannot be tested yet. Currently, it is outside of the scope of this research and as explained in the assessment, this will be either proven or disproven over time.

Table 5: Principle Assessment and Compliance

General Design Principles	Compliance
The design should clearly state its purpose, so the user knows what the design has to offer to avoid unclear expectations	<i>Compliant.</i> During the extent of this research, the scope, the domain, and its purpose have been defined as well as the expectations by the LARA project.
The design should be useable for the intended users, in this case for the stakeholders within the special cargo sector	<i>Non-Compliant (yet).</i> Due to the prospect of this ontology, as other researchers will apply NLP to enrich and populate it, the ontology is not 'complete' yet. Therefore, it is not useable in the extent of its' main purpose: to become a base of an AI route advisor. However, the objective to structure knowledge within the special cargo industry based on expert knowledge is accomplished.
The design should provide clarity over quantity, as it's more important to the stakeholders to have correct and useful knowledge than a multitude of it	<i>Compliant.</i> Based on the expert elicitation techniques, knowledge was derived, as well as needs within this domain. This knowledge and needs became the guidelines for the ontology. As non-transparency is a recurring problem within the domain, it was essential that this ontology provides transparency in the qualitative sense. As evaluated by the domain expert, the concepts were clear and linked in an evident method.
The design should be maintainable, as any data hardly goes without any updating	<i>Compliant.</i> Due to the nature of the program of Protégé, adding, adjusting, and modifying concepts, instances, and relation is straightforward.

The design should make use of expertise within the field	<i>Compliant.</i> The ontology is based on expert knowledge that was derived through the use of knowledge elicitation techniques.
The design should remain its stability throughout time, changes and additions	<i>Compliant</i> , so far. As the ontology is constructed as of late, time is hard to test on this design. However, similarly to the maintainable design principle, Protégé allows for adjustment and augmentation.
The design should aim to create greater efficiency compared to the previous state where the design will be implemented	<i>Non-Compliant (yet)</i> . The design is not implemented yet, as there is no application constructed nor is the design used as a base e.g. for semantic search. This principle will have to prove itself over time, as the ontology will be implemented into the LARA project.
Knowledge Structure Principles	Compliance
The design should offer clarity to effectively communicate the intended meaning of the defined terms	<i>Compliant.</i> As evaluated by the expert domain, the meaning of the concepts in relation to their definition as well as to other concepts was clear, as well as the relation to the tasks it possibly has to execute.
The design should be coherent amongst definitions and relations	<i>Compliant.</i> As evaluated by the expert domain, the coherence of the concepts in relation to their definition as well as to other concepts was clear.
The design should be extendable, as it should be able to add new terms	<i>Compliant.</i> Protégé allows for this.
The design should have a minimal encoding bias, as it should be independent of the issues of language	<i>Compliant.</i> When creating an ontology, certain decisions have to be made in how to model and structure knowledge. The guideline is to structure the domain, however, within the special cargo domain, certain relations are often not straightforward and evident. Therefore, choices must be made to model in such a way that the relations are clear but are approached with an encoding bias. But as an ontology is a representation of reality, this approach was avoided when possible, and therefore the principle is fulfilled, as the bias is aimed to keep to a minimum.
The design should be able to successfully integrate with its reasoners or machines	<i>Compliant.</i> Protégé has a built-in reasoner, and this functions fully with the constructed ontology.
The design should have minimal ontological	<i>Compliant.</i> The special cargo industry is one filled with jargon and industry-specific concepts; therefore, it is not possible to exclude complete ontological commitment. However, due to the input of

commitment to support knowledge sharing	different experts as well as the type of experts and documentation, a personal ontological commitment is nearly eliminated.
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Evaluation of Ontology

The evaluation was executed on two sets of 10 documents concerning special cargo, one subtracted from online sources concerning products and the other entailed news articles. The expert that annotated the documents has experience within the freight forwarding process as well as the risk analysis of lanes and is an employee of Validaide. It must be noted that there are some annotations not considered in the assessment, such as “transport project had to be carefully planned and all paperwork meticulously completed before the animal was able to take off” or other too specific statements, or that do not entail concepts or relations concerning the planning phase of special cargo. Furthermore, the ontology is a top-down created ontology and does not entail (many) instances as this was not the primary goal. Therefore, if specific instances are mentioned in the annotated concept, the higher-level concept will be considered, e.g. CarePod will be pet travel carrier. The annotated document can be found in section B of Appendix I, and the evaluation based on these annotations can be found in section A of Appendix I. The following notions were extracted from the evaluation:

- There were three concepts that were neglected in the original ontology which were implemented after the evaluation:
 - o ‘Certification’, as a head class of ‘Pharma Certification’- There are other certification in terms of special cargo besides the pharma one.
 - o ‘Hub’ as a subclass of ‘Airport’- A hub is the solely airport where a transit of flight occurs, thus often offers a greater variance of solutions.
 - o ‘Documentation’ as a separate class – This class can offer a lot of hindrance or the opposite when it’s done properly. Some airlines also offer help with the arrangement of documentation, thus therefore, it should be incorporated.
- The speed capabilities are extended with ‘minimum acceptance time’ and ‘delivery time’.
- During the evaluation, it became clear this some small or significant attributes were omitted in the process of creating the ontology. The following attributes were implemented in the ontology: ‘continuous monitoring’, ‘real-time tracking’, ‘connection time’, ‘warehouse capacity’, ‘capacity of pets’, ‘temperature monitoring’ and, ‘automatic cargo handling’. The reason attributes that were mentioned in the evaluation but were not augmented, is that

they are not vital to the election of one route or solution over another or are marketing terms to explain a general concept e.g. ‘sensitive handling of pharma’, sensitive is an adjective that is incorporate to appeal but does not distinguish itself from other solutions. Finally, some attributes ‘build-in hydration’ is too specific for the scope of the ontology.

7. Conclusions

In this chapter, the research conclusions and implications will be discussed based on the research questions and research objective. Subsequently, the recommendations of the study as well as future research possibilities will be debated, and finally the limitations.

7.1. Research Conclusions and Implications

This study is based on the main research question: “**In which way should a knowledge structure be constructed in order to support the planning phase within the special handling cargo sector?**”. First, the sub-questions will be answered to coherently answer the main research question.

- *How can knowledge aid the digital transformation of the special cargo sector?*

In chapter 3, the concept of knowledge and innovation based on knowledge implementation and structuring is discussed. Knowledge and information are seen as the base of a ‘smart’ industry, but within the special cargo industry, these facets are non-transparent. When knowledge is structured and transparent, this can become a competitive advantage as customers and their needs are accessible and understandable. Knowledge can be implemented into systems or applications, thus increasing accessibility of knowledge and removing human error and overall increasing efficiency.

- *Which is the best knowledge structure to aid the special cargo sector?*

In section 3.5, different knowledge bases and structures are discussed, as well as the difference between these two concepts. Based on academic research (Martinez-cruz et al., 2012) and the general advantages and applications, e.g. semantic web, of an ontology, this knowledge structure was chosen to be constructed.

- *What are the possible knowledge structure engineering methods?*

In chapter 3, different knowledge engineering methodologies are briefly touched upon, and in chapter 4, different ontology engineering methodologies are discussed. As mentioned, knowledge engineering and ontology engineering are different engineering fields, yet offer similarities as they both aim to gather knowledge. Knowledge engineering has maturity in the collection of knowledge; however, it does not offer how to structure this knowledge within an ontology. Therefore, an augmented methodology was created to optimize the use of knowledge gathering based on knowledge engineering principles in combination with the methods of structuring the knowledge in an ontology. Based on an analysis that is executed in chapter 4, and assessed in chapter 5, the UPON methodology was chosen as a base of the created methodology and was augmented with knowledge elicitation techniques as well as evaluation techniques.

- *What are the specific knowledge requirements in the cargo sector?*

In the ORS document that was orchestrated, contains functional as well as non-functional requirements, which the ontology must adhere too. These requirements were extracted from the needs from the experts alongside reports.

- *Which are the main and secondary concepts and attributes of the domain?*

Based on the knowledge elicitation techniques analyzed in chapter 4, and assessed in chapter 5, knowledge was extracted from experts' minds and structured. Based on the OPAL methodology, there were ranked and ordered, and can be found in Appendix F and G.

- *How is the knowledge structure implemented?*

The knowledge structure is constructed in Protégé, which was analyzed in chapter 4, and assessed in chapter 5. As mentioned throughout the thesis, there are several applications of an ontology, e.g. semantic web, knowledge base structure, etc. For the special cargo ontology created for the LARA project, there are two specific applications, i.e. to function as a knowledge base when instances are applied and as a base to an artificial intelligence route advisor. These implementations are not in the scope of this research, however, serve as a guideline in how the ontology should operate.

- *How is the knowledge structure evaluated?*

In chapter 4, different evaluation techniques were discussed, with four main strategies namely gold standard, application-based, data-driven, and user- or human-based. In chapter 5, these

were assessed. Due to the lack of gold standard, (technical) application, and data, human assessment was the main reference point. To eliminate as much subjectivity as possible, the evaluation was split into two. The assessment, where competence questions and principles were assessed and the evaluation which consisted of a manual annotation approach to 20 documents that were annotated by an expert.

The main research question “In which way should a knowledge structure be constructed in order to support the planning phase within the special handling cargo sector?”, can be answered accordingly to these sub research questions. An ontology was constructed, based on an augmented methodology with appropriate knowledge elicitation and evaluation techniques and designed to adhere to the constructed principles and requirements.

The objective was to develop a knowledge representation of the special handling goods and services in the airfreight sector based on a designed methodology that will digitalize the determination of the choice set for airfreight forwarders by making data transparent and understandable to machines. This was based on the needs of the innovation deficient industry of special cargo. This objective was executed, and the final design is a top-down ontology that can function as a knowledge structure. Furthermore, a thorough methodology was constructed that considers more than just structuring, gathering or evaluating the (structure of) knowledge of a top-down ontology, but combines all these facets. Finally, the analysis of the components of ontology construction can offer insight into which methodology, knowledge engineering or evaluation technique to use.

7.2. Recommendations and Future Research

For the continuation of this study as well as the LARA project, the ontology should be elaborated upon, which can be executed in multiple methods; applying NLP to a built corpus to enrich and populate the ontology, manually populating the ontology or semi-automatically enrich and populate the ontology through ontology tools. The main purpose of the ontology was to structure knowledge but implementing it into an application, e.g. AI-based or query-based, would fulfill the business aspect of the LARA project. Finally, for academic purposes, the constructed methodology could be elaborated upon in terms of semi-automatic tools, or application of evaluation techniques based on when demand calls upon these aspects.

7.3. Limitation

The ontology construction and research were done in the utmost academic approach; however, limitations are still found. Firstly, the absence of application/data hindered the process in more ways than one. The evaluation had to be augmented and adjusted due to this absence, as well as the approach of abstracting concepts, i.e. semi-automatic tools were eliminated, which abruptly the thorough examination of the internet. The lack of query language skills resulted also supported the deviation to different types of evaluation. This deviation omitted the assessment of two evaluation criteria, namely cohesion and coupling as there was no method to evaluate these criteria.

As mentioned before, there is no ‘good’ ontology, as every ontology is constructed by different individuals with different interpretations of how knowledge should be modeled. The fact that the ontology was constructed by one individual, does heighten the bias thus decreasing objectivity. Furthermore, the ontology was constructed by a novice ontology engineer, in comparison to a domain expert who could possibly have implemented extensive information that was not extracted by the ontology engineer, i.e. unknowns-unknowns remained uncovered. Moreover, an ontology is an evolving artifact, and therefore will never be ‘done’, as information will be added over time.

The LARA project plan was constructed before this research commenced and is it project plan the first work package calls upon ontology construction. Whilst academic research has found that ontology is an appropriate knowledge structure for the special cargo domain, it was a given and approved knowledge structure, which eliminates objectivity partially.

Other limitations such as limited availability of editors, knowledge resources or other programs due to financial limitation, copyright or academic limitations proceeded to hinder within the research. Another practical limitation is the absence of recording of the unstructured interviews. These were often prompted unexpectedly and throughout social or day-to-day conversations, which hindered the recording of these techniques. Finally, the concept of risk within the ontology is a mere simplification of reality. Risk is a complex and substantial, numerous companies specialize within risk assessment and modeling, and therefore falls outside of the scope of this ontology.

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Appendix

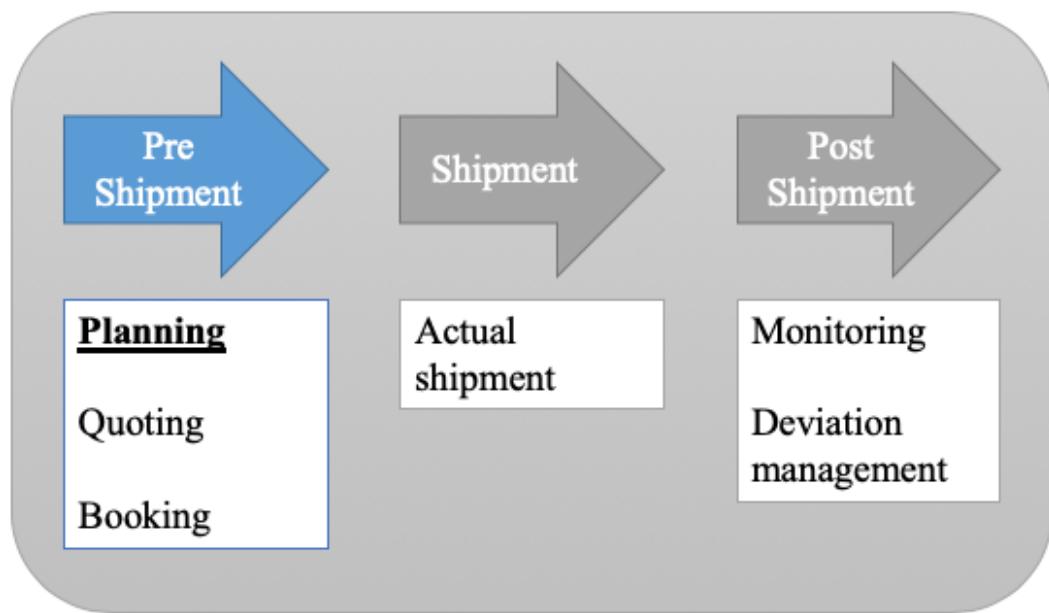
Appendix A: ORS Document

Ontology Requirement Specification

Task 1a) Purpose

The main function of this ontology is to structure and digitalize the special cargo sector. More specifically, the determination of available choice set for routing options including specific product features and capabilities and services or air carriers and ground handling agents. (to structure the available knowledge)

Task 1b) Scope



The planning phase within a special cargo shipment

Special cargo consists of

- Pharma - medicine as well as medicine supply
- Dangerous Goods
- Perishables
- Live Animals
- High Value

Task 1c) Implementation Language

OWL - in Protege

Task 2) Intended End-users

Validaide, Operational users in e.g. airfreight forwarding business, optional shippers

Task 3) Intended Uses

As a structure for knowledge and base for the special cargo application

1. Search and retrieval of semantic enriched documents
2. Devices are able to process/interpret these documents
3. Ontology-based reconciliation
 - between a freight forwarder & airline/sea shippers
 - between a producer & freight forwarders
4. Create the ability to standardize products and capabilities and services
5. Function as a (knowledge) base for population
6. Function as a (knowledge) base for application: to know which product and route serves the needs of a shipper/freight forwarder
7. Reuse of domain knowledge

Task 5a) Non Functional Requirements

- English
- Accuracy
- Extensible
- Interoperability

Task 5b) Functional Requirements

Competency questions based on Ren et al. (2014) - “Does <class> + <property> <class>?”

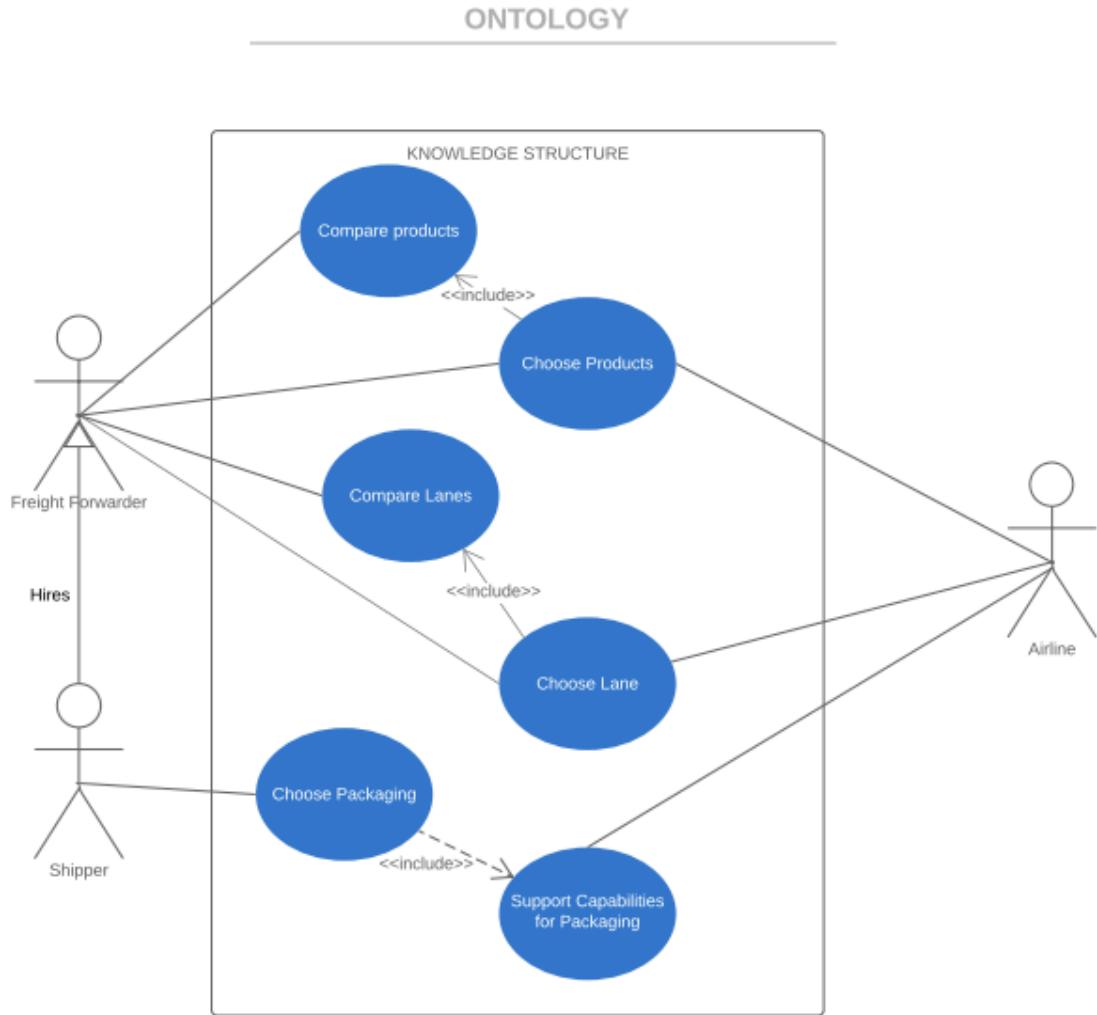
1. Does a pharma solution have a booked temperature range?
2. Does lithium batteries transport have restrictions?
3. Is there a difference between pharma products and live animal products?
4. Does special cargo have special handling codes?
5. Does general cargo have special handling codes?
6. Does shipment characteristics, such as temperature, affect the product that is chosen?
7. Does the tarmac influence temperature risk?
8. Does the air carrier product offer packaging?
9. Does the shipper book the shipment?
10. Do capabilities play part in the products airlines offer?
11. Does exposure time influence temperature risk?
12. Does a 2 to 8 degrees shipment require packaging?
13. Is an airport located in a country?
14. Do horses require special transport?
15. Does an airline do the handling of the shipments?
16. Can a pharma product have multiple temperature aspects?
17. Does a lane consist of only flights?

18. Do pharma solutions require certain handling capabilities at the airport?

Task 5c) Grouping Functional Requirements

Competence Package Group	Competence Questions
Product or Service PRIORITY	1, 2, 3, 6, 10, 18
Lane	7, 11, 17
Packaging	8, 12, 14,
General Components or Process	4, 5, 9, 13, 15, 16,

Appendix B: Use-Case



Appendix C: Interview Base

Interview Questions

The interview will mostly focus on the planning phase of the special cargo sector. Special cargo in this context is all the cargo that does not concern ‘general cargo’ e.g. Pharma, Live Animals, Dangerous Goods, Etc. Goods that need special handling in its transportation. The planning phase consists of the process before the actual shipping takes places, e.g. choice of airlines, services, or lanes.

Freight Forwarders

1. What is your main job or task you fulfill?
2. What tasks do you fulfill in the planning process of special cargo?
3. What do you think are the most important parts of the planning phase in special cargo in general?
4. Who do you think are the most important players of the special cargo sector?
5. What do you think are the important/critical aspects within the planning phase of special cargo?
6. Could you, in short, list the main tasks associated with the planning of special cargo?
7. What do you think is the hardest task when planning a special freight shipment?
8. Do you perhaps have extra sources/literature/data concerning special freight?

Job specific

1. Could you tell me about a typical case in which you selected the routing for a special cargo/pharma shipment?
2. Is there an order within typical cases, if so which one?
3. What errors are most common or most critical when executing a typical case?
4. Could you tell me about an unusual case?

Offers and products

These questions concern the offers a freight forwarder makes, and which products and services one chooses from air carriers, and how one chooses them.

1. How many offers do map out for the shipper to choose from? And why?
2. How do you map these offers?

3. How do you determine which offers you make?
4. How do you choose which comprises to make?
5. Are these different types of offers/compromises depended on the shipper and their demands?
6. Which tools do you choose in making offers/determining which products and services to use?
7. Is it clear which products an air carrier has? And if not, how do you find out?
8. How do you obtain information about the products of an air carrier?
9. How do you compare the different products of different air carriers?
10. How do you know which airports/locations has which products/services?

Air carriers

1. What is your main job or task you fulfill?
2. Could you tell me about a typical case in your function?
3. How are certain products/services created?
4. What errors are most common or most critical when executing a typical case?
5. Could you tell me about an unusual case?
6. Do you concern yourself with the products and services of pharma?
7. What do you think are the most important parts of the planning in pharma in general?
8. Who do you think are the most important players in the pharma sector in the planning phase?
9. Who are your direct and indirect customers?
 - a. What is the relationship with them (on transactional basis?)
10. What do you think are the important/critical aspects within the planning phase of pharma?

Ground handling

1. Do you retrieve information about ground handlers when planning a shipment?
2. If not, how do you convert this (nonexistent) information to your customers?
3. Can ground handlers be considered critical in the planning process of special cargo?

Do you perhaps know anyone who could be of interest for my research? Extra sources about special freight?

Appendix D: Interview Transcriptions

Transcription Interview 1

- 0:00 - 0:59 Tess

In het eerste deel van het interview, geeft Tess een korte introductie over wie ze is (*graduate intern van MSc Innovation management*), wat ze doet (*onderzoek als graduate Intern bij Validaide*), en ze geeft een korte uitleg over het LARA (*Lane Analyzation and Route Advisor*) project. Het project heeft als doel om de special cargo industrie te digitaliseren en te optimaliseren. Special cargo is alle non-general cargo, zoals medicijnen, levende dieren, bloemen. Tess haar deel bestaat uit het structuren van de kennis over de special cargo, en met name de planning fase hiervan, omdat de kennis niet transparant, ongestructureerd is en ‘hard to comprehend’ voor machines. Tess bouwt een soort woordenboek of ‘vocabulary’ zodat machines de special cargo kunnen begrijpen. Tess geeft ook een korte introductie in wat voor vragen ze zal stellen, over de planning phase en de producten van air carriers, en over wat zoals Pharma shipments, Ground Handling Agents, etc.

Mijn eerste vraag, u werkt bij Company X, Manager, zag ik?

- 0:59 - 1:59 Manager

Klopt, ik ben airfreight health care manager. Ik ga eigenlijk over alle transporten wereldwijd, van Company XX. Dus farmaceutische transporten maar ook andere zoals bijvoorbeeld medical devices. Temperatuur gecontroleerde maar ook non-temperatuur gecontroleerde pharma, zoals medical devices die niet op temperatuur gecontroleerd hoeven worden. En alles alleen met luchtvracht, dus enkel en alleen luchtvracht.

- Tess

Dus ‘only airfreight’. U doet dus ook de non-temperature controlled dingen, terwijl pharma juist vaak alleen maar temperatuur controlled.

- 2:00 - 2:59 Manager

Ik ben dus ook geen pharma manager, maar health care manager. Wij hebben gezegd, als we kijken naar onze gemiddelde klanten, we hebben klantenbenadering gedaan. Onze gemiddelde klanten die hebben meerdere producten. Binnen dat kader hebben we een hele grote groep klanten die farmaceutisch zijn, daarvan weten we precies wat ons te wachten te staat. Maar we hebben ook een grote groep klanten binnen dit kader die medical devices hebben. Medical devices markt is een redelijk grijsg gebied op dit moment. Zeker als we het hebben over ‘moet de temperatuur gecontroleerd vervoerd worden of niet?’. En aangezien wij forwarder zijn, moeten wij natuurlijk maatstaven geven. Dus als wij zeggen temperatuur gecontroleerd, prima. Dat gaat dan volgens onze hoogte maatstaf, en dat is de GDP (*Good Distribution Practices*), en dan voldoet het aan de pharma service, om het zo maar te zeggen. Medical devices kunnen ook pacemakers zijn, kunnen ook zijn implantaten. Dat soort zaken. Heel belangrijk dat ook die zaken, dat deze producten ook op een bepaalde temperatuur gehouden worden.

- 2:59 - 3:59 Manager

Dus vandaar dat wij hebben gezegd, ‘ja weet je’, wij hebben daar ook nog erg strenge benaderingen voor, dat erg in de buurt komt van de GDP. Wij hebben gezegd, binnen Company XX, past dit binnen Healthcare. Omdat wij ook met zulke klanten spreken, m.b.t. de luchtvracht an sich, dat heel veel klanten ook een portfolio hebben aan non-temperatuur gecontroleerde vracht. We hebben gezegd, laten we dat in hetzelfde kader plaatsen, onder Healthcare, want het zijn allemaal Healthcare doeleinden. Dat we daarin verschillende subdivisies maken. Dus zo hebben wij het gedaan.

- Tess

Ah oké. Dan heb ik eigenlijk ook nog wat vragen specifieker op u, wat is uw achtergrond? Zat u al langer in Freight forwarding, of net een paar jaar?

- 3:59 - 4:56 Manager

Ik zal m’n levensverhaal even vertellen, ik ben momenteel 32 jaar en ik werk vanaf m’n 17^e op Schiphol. Dus ik eigenlijk ken ik niets anders dan luchtvracht. En, ik heb verschillende dingen gedaan, ik heb in deloods gestaan, dus ik heb daar platen opgebouwd bij de grond afhandelaar, Ground handler zoals jij dat mooi in het Engels zegt. Ik heb bij de luchtmaatschappij gewerkt, bij XX airlines. En ik ben bij keuringscentra geweest, daar heb ik kort gewerkt. Heb nog even bij een andere freight forwarder gewerkt, maar ik werk ondertussen 10 jaar voor Company XX, en daar heb ik verschillende posities bekleed. Van operationeel tot aan supervisor rol, pricing manager Benelux en nu global verantwoordelijk voor health care.

- Tess

Oké, dus je hebt eigenlijk alle takken wel een beetje gehad.

- 4:59 - 5:59 Manager

Binnen de kleine wereld van Airfreight heb ik, denk ik, de meeste takken wel gehad. Het zal je verbazen hoeveel andere takken er nog wel zijn, maar die belangrijke takken die heb ik wel gezien.

- Tess

Ja, ik kom er zelf nu ook steeds meer achter, het is niet zo eenvoudig allemaal.

Als Global Airfreight product manager Healthcare, wat is jouw main task? Is dat echt het boeken van shipments of meer het overzien?

- 5:33 - 6:54 Manager

De main-task is meer het ontwikkelen van het product. Dus de reden waarom we bijvoorbeeld naar Validaide zijn gegaan, of dat wij hebben gezegd, wij erkennen binnen ons bedrijf dat wij de risico’s op een route niet zo goed inzichtelijk hadden, en dat is dan het ontwikkelen van het Healthcare product voor ons. Daar ben ik dan verantwoordelijk voor. Daarnaast ben ik officieel

uiteerdaard verantwoordelijk voor de zaken die gebeuren. Ik boek zelf geen zendingen, maar ik kijk wel naar de verschillende stromen en op hoger niveau handel ik dan ook met de luchtvaartmaatschappij om te zeggen, kunnen wij het anders doen, kunnen we het niet beter naar een andere bestemming sturen en dan met een vrachtwagen doorsturen bijvoorbeeld, dat we zendingen kunnen combineren. Dus ik heb een vrij brede rol binnen Company XX.

Het is met name het ontwikkelen van het product en dat heeft meer te maken met, ik denk dat dat voor jou het meest interessant is, hoe maken wij keuzes in wat voor verpakkingen wij gebruiken als de klant het aan ons overlaat? Hoe stellen wij risico's opeen route, hoe willen wij dat onze operators, de mensen die de boekingen maken, omgaan met hun klanten? Hoe gaan ze om met de boekingen die ze krijgen, hoe doen ze dat? En dat is eigenlijk het gene wat ik uitstippel.

- Tess

Oké! Dat is inderdaad wel een groot onderdeel van mijn onderzoek, van ‘hoe maak je bepaalde keuzes bijvoorbeeld in verpakkingen’. U werkt dan niet specifiek met 1 shipment, maar stel, je hebt 2 tot 8 gekoelde medicijnen. Die kunnen met active containers, passive containers, dry ice, gel packs, van alles. Hoe maak je beslissingen welke verpakking je kiest?

- 7:39 - 7:58 Manager

Dat is een hele goede vraag en dat is eigenlijk ook een beslissing die wij niet nemen. Want heel eerlijk, voor elke gradatie in risico, je zegt het zelf, active container, dan heb je een vrij laag risico. Je hebt ook hele goede passive containers tegenwoordig, waarbij wij zeggen, dat risico is om en nabij hetzelfde. Dus daar heb je hele lage risico's, maar de kosten voor zo'n container, het huren van zo'n container, is enorm prijzig, dat is enorm duur. Nou ja, daarnaast hebben we dan ook nog andere passive oplossingen die wat goedkoper zijn en die ook prima werken, maar waar weer meer risico's aan verbonden zijn. En daarnaast heb je dan ook weer thermo blankets, daar zitten helemaal geen koelementen of iets dergelijks in, dat is gewoon een bescherm materiaal. En dan heb je nog een gradatie waar we helemaal niets toevoegen, enkel aan de luchtmaatschappij vragen, ‘kunnen jullie de zending niet temperatuur-gecontroleerd vervoeren?’ Daarom is Validaide zo belangrijk voor ons, omdat zij in het laatste scenario kunnen bekijken van, oké, waar liggen nou de risico's? Waar in het project liggen nou die risico's? Nou, het grootste risico ligt altijd op het platform, bij de tarmac, de tarmac time, zoals wij het zeggen. Waar je dan ook naartoe gaat, welke luchtvaartmaatschappij je gebruikt, als je in Dubai staat, dan word je toch geconfronteerd met 50 graden in de zomer soms. En in Chicago in de winter word je geconfronteerd met -20, dus dat is een strenger klimaat daar.

Dus dat zijn best interessante vragen die je stelt, ‘hoe maken wij daar beslissingen in?’. Nou, wij kunnen dat dus niet, zoals ik dat al eerder zei. Dat moet echt de klant doen. Wij hebben daar wel een hele belangrijke rol in. Je hebt heel veel klanten die het al hebben uitgedacht, die kennen de risico's van het traject, hebben daar hun eigen procedures voor. Die zeggen, ‘wij willen deze service, een active container’. Nou, dan zijn wij eigenlijk klaar, dan boeken wij die active container en dan gaan we door. Als een klant zegt, ‘ik wil geen verpakking’, dan moeten we ze dus echt wijzen op het feit dat er risico's op het traject zitten. Maar wat wij meestal doen,

wat onze beschreven procedure is, we hebben regelmatig klanten die zeggen, ‘we hebben een zending van 2 tot 8, wat jij een beetje beschrijft, dat moet naar Chicago bijvoorbeeld, en dat is 2 tot 8, boek ‘m maar’. Ja, dan moeten wij echt even kijken wat we gaan doen. Dan gaan we een analyse maken, we wijzen de klant op het feit dat het risico heel groot is, dat de zending geconfronteerd wordt met andere temperaturen, met ambient temperaturen. Op basis daarvan vragen wij aan de klant om stability data af te geven, elk medicijn heeft een verschillende stability data. Sommige klanten zeggen, ‘ja oke, we vragen wel 2 tot 8, maar eigenlijk is de stability data dat het een week tussen de -20 en +50 mag worden, ik zeg maar wat. Dan zeggen wij, prima, als dat het geval is, dan maken wij daar een berekening van. Die leggen wij dan even achter elkaar, vragen we Validaide natuurlijk even voor de uitkomst van wat zij zeggen, en dan zeggen we, ‘het komt in ieder geval niet binnen de -20 en +50, ik zeg maar wat hoor, wij zijn geen farmaceuten, we zijn slechts transporteur. Dus dan zeggen wij, nou, dat risico is zó klein dat dat gebeurt, dat vertellen we dan ook, dat het risico heel klein is dat de zending in een week tijd deze temperaturen bereikt. Dus dan adviseren wij dat gewoon tussen 2 en 8 graden te vervoeren. Je hebt ook klanten die zeggen, ‘nou, nee, het moet strikt 2 en 8 blijven, het mag niet erboven en niet eronder, geen moment’. Daarvan zeggen wij, ‘oké prima, maar als u het wil transporteren, dan komt u wel met andere temperaturen in aanmerking. Wij adviseren hiervoor bijvoorbeeld een envirotainer, of een hele hoge kwaliteit passieve container bijvoorbeeld. En dat heeft deze kosten. Waarom wij deze keuze dan niet maken, is omdat die klant moet bepalen, ‘wat zijn dan de risico’s?’ Dus stel je voor dat er een temperatuur excursie is, wordt die dan compleet geschrapt of moet er misschien een test worden gedaan of het medicijn nog goed is? Dus wij vertellen wat de risico’s zijn, wij bieden dat aan, wij zijn eigenlijk de adviseur van de klant op dat moment, waarbij we verschillende opties hebben. Maar we hebben bijvoorbeeld ook klanten die een heel laagwaardig product hebben, 2 8, bijna strikt. Wij zeggen dan bijvoorbeeld ‘een envirotainer’. Die klant zegt, ‘als we dát moeten betalen, dan kan ik het beter niet versturen’. Nou oké, dat is vervelend, dat willen we ook niet, ‘dus wat zijn dan de andere opties?’ vraagt de klant. Dan zeggen wij, lagere vorm van passieve zendingen, dat soort zaken. Dan neemt die klant eigenlijk het risico door te zeggen, ‘wij nemen het risico dat er het risico bestaat dat er een temperatuur excursie plaatsvindt op bijvoorbeeld 20 procent van onze zending’. Want de zending is heel laagwaardig, maar er komt nog 80 procent alsnog aan. Dus dan hebben zij het risico, het financieel risico kunnen wij als forwarder niet nemen. Dat ligt echt bij de klant zelf. Zo doen wij wel, we weten wel dat er forwarders zijn die wél dat risico nemen en ik denk dat dat meer in het sales verhaal is. Dus dat zij zeggen, ‘we willen heel graag de klant binnenhalen’, en dat ze dat dan maar beloven op bepaalde manieren. En zich dan gaandeweg proberen, als zo’n temperatuur excursie er is, niemand zal er een contract voor tekenen of zeggen, ‘wij nemen die verantwoording daarvoor’. Geen enkele forwarder zal dat doen. Mits het echter iets heel specifieks is, dat ze het bijvoorbeeld combineren met een andere vracht, maar dat gebeurt echt heel erg weinig, ik heb het nog niet eerder gezien.

- Tess

Oké, dat wist ik niet dus dan leer ik weer wat. Even kijken, dan heb ik een iets andere vraag, in het planproces van een pharma shipment, wat zijn de belangrijkste delen? Waar moet je echt,

ja, temperatuur is dan een heel belangrijk deel, maar wat zijn nog andere hele belangrijke aspecten die in de planfase van zo'n shipment mee kijken?

- 14.26 Manager

Je zegt het zelf he, de temperatuur is belangrijk. Kijk, in theorie is het niet heel anders dan een normale, non-pharma zending. Daar heb je een procedure voor, ik weet niet of je die kent?

- Tess

Voor meer general cargo? Die ga ik dan even opzoeken, want die zou ik nu niet zo weten.

- 14:56 - 15:57 Manager

Kijk, ik kan je namelijk wel vertellen wat de procedure daarvan is maar ik geef de voorkeur om je te vertellen wat dan afwijkend daarvan is.

- Tess

Ja, dan zoek ik het zelf wel op!

- 15.08 – 15.34 Manager

Ja, ik wil het je ook wel uitleggen, dat maakt mij niet heel veel uit. Het enige is, waar echt rekening mee gehouden wordt is het kwalitatief gedeelte, dat begint al bij, laten we zeggen, het exportkantoor in Nederland om het even makkelijk te houden. Dat begint dus hier in Nederland, en wie haalt dan uiteindelijk de zending op? Het is heel belangrijk voor iemand die pharma boekt dat ze de lijst van de GDP volgen. Die zijn ook getraind, die mensen die dat boeken. GDP ben je wel bekend mee of niet?

- Tess

Ja, is wel meerdere keren voorgekomen, ja.

- 15:39 – 20:08 Manager

Oké, dus de mensen die dat boeken zijn GDP getraind en die bepalen dan ook, ‘oké, welke transporteur haalt de zending op?’ Daar heb je wel minder keuzes uit vaak, omdat je met general cargo alles en iedereen mag gebruiken in feite, dan heb je het over productkwaliteit, niet over performance kwaliteit om het zo maar te zeggen, om dat te waarborgen. Maar wij moeten juist uit een pool kiezen, waarbij transporteurs, tech-transportbedrijven, zich hebben verdiept in de GDP en daar een compleet plan hebben klaarliggen, een goede kwaliteit van managementsysteem klaar hebben liggen, en dat trailers die zij gebruiken, inclusief personeel die zij hebben, voldoen aan de GDP eisen. Dat geldt niet alleen daarvoor, dat geldt ook voor cross-docking operatie. Vaak laten wij als exporteur de zending ophalen bij de klant en dan brengen wij ‘m in eerste instantie naar een eigenloods, omdat we de zending willen wegen of er een sticker op willen plakken met vrachtgegevens, of we willen daar wat mee doen. En daarna brengen we het naar de grondafhandelaar. Maar dat stukje, dat loods-stukje van Company XX zelf in dit geval, als we dat willen, we kunnen ook besluiten om het direct af te

leveren bij de grondafhandelaar, maar als zij daar reden voor hebben, en vaak met farmaceutische transport is dat er wel, dan moeten we ook zorgen dat die omgeving van die loods ook voldoet aan de GDP eisen. Dus dat betekent dat het altijd schoon moet zijn, dat wij een audit uitgevoerd moeten hebben. Dat geldt ook voor die wegtransporteur, wij moeten gecontroleerd hebben of zij wel volgens die eisen voldoen.

Daar zit een stukje temperatuur gecontroleerd in, hoe wordt de loods temperatuur gecontroleerd? Heeft iemand z'n vinger in z'n mond gestoken en zegt, nou ja, ongeveer 15-25. En nemen ze daar genoegen mee. Of wordt er echt actief gecontroleerd en wordt dat gemeten en bijgehouden? Maar ook gecontroleerd op, wat zijn jullie plannen als de stroom uitvalt bijvoorbeeld. Wat doet iemand dan? Op basis daarvan, heeft Company XX's kwaliteitsafdeling al een analyse gemaakt en gezegd, 'deze tender is daar voor deze activiteiten goedgekeurd'. Het is wel belangrijk dat degene die dus de zending boekt, ook die tenders checkt. Of het zelf hebben gedaan, als wij zelf natuurlijk een loods hebben die goedgekeurd is, prima. Maar gaan we het outsourcen, dat we wel de juiste tenders daarvoor aanstellen. Ik denk dat dat een heel belangrijk aspect is. Bij de luchtmaatschappij is het eigenlijk heel erg makkelijk, je geeft door aan de luchtvaartmaatschappij dat het pharma is en tussen welke temperaturen je het graag wil hebben. Dat zijn 3 temperatuur ranges, dat is 2 tot 8, 2 tot 25 en 15 tot 25 graden. En dat is eigenlijk een vrij makkelijk gedeelte, want daarmee kan je ook aannemen dat de airline daarvoor geschikt is.

Overigens, voor de luchtvaartmaatschappij, dat is ook een vendor van ons, die is ook voor een bepaalde manier geklassificeerd. Nou wordt het wat ingewikkelder, want het ligt eraan of die lane dus al bestaat. De klant heeft bijvoorbeeld gezegd, 'deze luchtmaatschappijen zijn goedgekeurd op deze routes, of de services van deze routes'. Maar het kan ook zo zijn dat we klanten hebben die zeggen, 'we willen 2 tot 8 en doe jij het verder maar'. Dat betekent wel dat wij dan van tevoren een SOP hebben gemaakt voor die lane, waarvan we zeggen, deze zendingen moeten geboekt worden bij die luchtvaartmaatschappij op deze service, om zo te zorgen dat de temperatuur niet zal uitwijken en dat ze opeens naar Chicago gaan in plaats van Dubai, om in Nieuw-Zeeland te eindigen. Want dan weet ik zeker, in Chicago wordt het -20, misschien is de verpakking die wij daarvoor gebruiken of die de klant daarvoor gebruikt, niet goed geschikt voor -20 maar juist wel voor +50. Om de temperatuur binnenin te waarborgen. Dus eigenlijk gaat alles samen met procedures. Dat is belangrijk, dat je operator daarvoor getraind is en dat ook volgt.

• Tess

Ja, want ik denk dat er ook wel waarschijnlijk de grootste fouten worden gemaakt als de operator het niet precies volgt.

• 20:17 – 22.48 Manager

Dat, of dat er verkeerd is ingeschat door iemand. Wat we vaak bij bedrijven zien is dat de sales mensen naar klanten toe gaan, en die willen gewoon scoren. En die beloven altijd gouden bergen en zeggen dan, '2 tot 8, dat kunnen we boeken'. Dus dat mensen zelf wel goed zijn getraind maar dat de sales niet zo goed is getraind. Dat zie je toch wel vaak in trainingen

terugkomen, dat het fout gaat. En dan zit er ook een klein stukje non-performance, je zit in de luchtvaart eigenlijk met de meest risicovolle mobiliteit om iets te vervoeren. In zeevracht zet je een container neer, die doe je open, die staat op een temperatuur en die sluit je weer. Het enige dat belangrijk is, is dat die container wordt ingeplugged, dus dat er energie naar die container blijft gaan zodat die ‘m op temperatuur houdt. Maar in de luchtvracht is het zo, envirotainer is dan eigenlijk nog nagelaten want dat kan je ook bij de klant neerzetten en dan laten laden en dan pas bij de klant aan de overkant laten uitladen, dan heb je hetzelfde principe bijna. Maar in theorie wordt de meeste vracht niet actief gecontroleerd en dat betekent dat je echt afhankelijk bent van de passieve omgeving en van heel veel handjes. Want je ziet het zelf, het zijn de wegtransporteurs, forwarders die je boekt, de cross-docking operatie die iets uitvoert, dan is er nog een wegtransporteur die ‘m naar de grondafhandelaar brengt, de grondafhandelaar moet het goed doen, de luchtvaartmaatschappij moet het goed doen, een tussenlocatie als dat van toepassing is, dus op een transfer airport. De destination moet het goed doen aan alles wat er aan de destination kant gebeurt, moet ook nog goed doen.

Dat zijn heel veel schakels eigenlijk, en dat maakt de luchtvaart over het algemeen toch wat risicovoller. Om dat nou minder risicovol te maken, zijn er dus verschillende gradaties verpakkingen. Dat is dan het laatste wat de operator wel moet behandelen. Mocht het nou zo zijn dat er geen SOP is of dat soort dingen, dan komt het sales verhaal weer. Dan is de operator verplicht om te zeggen, ‘er zijn een x aantal risico’s in het vak, hebben jullie dat ingecalculeerd?’ Maar de klant blijft altijd de baas. Dus als de klant zegt, ‘ja prima, wij hebben dat op papier staan’, dan gaan we van start, dat doen we dan.

- Tess

Oké, want jij noemde SOP’s een paar keer. Ik heb een term waar ik vaak tegenaan loop, special handling codes, worden die ook in SOP’s behandeld? Of zijn special handling codes meer instructies? Dit is meer een informatieve vraag.

- 23:03 – 24.37 Manager

Ik denk dat iedereen een eigen term heeft voor verschillende dingen. Wij werken met SLA’s en SLP’s, dat soort zaken. We sluiten met vendors die we hebben, SLA’s af, Social Level Agreements. We hebben werkinstructies, dat verwerken wij eigenlijk in de SOP’s. Dus we maken daar een aparte kolom voor, die de operator dan makkelijk naar voren kan brengen. Want wij zijn in het verleden in de situatie terecht gekomen waarin we voor elke klant een SOP hadden, dan heb je meer een agreement met de klant. En dan hebben we een aparte werkinstructie en apart iets anders. We hebben gezegd, ‘laten we dat nou combineren’, voor onze eigen administratie om het zo maar te zeggen, dat het eigenlijk allemaal helder is. Soms is het wel eens heel lastig want we hebben ook hele grote klanten wereldwijd, die wereldwijde SOP hebben. Om dan te zeggen, we gaan het helemaal onder splitsen, elk land, elke lane kan ook andere werkinstructies hebben en we gaan al die werkinstructies in die SOP stoppen. Daarvan hebben we nou gezegd, wij zitten in die SOP’s en de verschillend werkinstructies die er dan gemaakt zijn op lokaal niveau. Dus zo doen wij dat, we hebben echt een gradatie gemaakt van: global accounts en local accounts.

- Tess

Oké, want je zei op een gegeven moment ook dat bepaalde lanes vast staan, met welke air carrier om het zo maar te zeggen, en ground handling agents. Maar stel, je moet een apart shipment, een beetje een exotisch shipment maken. Heb je dan bepaalde luchtvaartmaatschappijen waarmee je altijd boekt? Bijvoorbeeld die ook kwalitatief, een agreement mee hebt? Of is het meer, deze vlucht gaat hierop, deze nemen we mee?

- 25:05 – 25:10 Manager

Ik begrijp je vraag niet helemaal, je zegt een exotische zending, dus ik zou graag willen weten wat je met een exotische zending bedoelt.

- Tess

Een niet-vaak voorkomende zending, niet een lane die al is uit bedacht maar een andere route.

- 25:19 – 27:01 Manager

Wat ik al zei, van alle informatie die we al hebben, van de klant of van het product, dat kunnen we meenemen. Maar ga er even vanuit dat wij nog niets weten, dus dat we een klant hebben waarvan alleen Amsterdam naar Dubai staat. En in een keer zegt die klant, ‘ik wil graag naar Nieuw-Zeeland’. Ja, wat doen we dan? Dan kunnen we twee dingen doen. Het ligt er een beetje aan, we gaan een analyse maken. We maken een risicoanalyse van onszelf, dus stel je voor dat wij nou de Emirates gebruiken die normaal gesproken naar Dubai gaat, maar dan een stukje langer naar Nieuw-Zeeland. Dan moet het wel hetzelfde product zijn, met dezelfde stabiliteit data. Dan leggen we dat voor aan de klant en de klant moet daar dan goedkeuring voor geven. Weten wij helemaal niets want is het een heel nieuw product of heel iets anders, dan is het wel belangrijk dat we dan ook weer opnieuw beginnen. Om te kijken met die klant, ‘wat is nou de stabiliteitsdata, wat wil je hiervoor gebruiken?’

We zien wel gaandeweg dat veel klanten wel wat meer kennis bezitten van de luchtvracht, dus vaak hoeft dat niet en komt de klant al heel vaak met oplossingen die niet door ons uitgedraagd hoeven te worden. Misschien dat wij vervangende oplossingen kunnen aandragen om kosten te besparen of dat soort zaken, want dat is natuurlijk ook een heel belangrijk aspect. We zijn een commercieel bedrijf en je probeert winst te behalen. Niet alleen wij, maar ook de klant. Ja, dat we daar altijd naar blijven kijken. Dus ja, een exotisch product of exotische zending wat je zegt, dat zal dan toch echt meer in de lijn, in de SOP gaan, dan een nieuwe zending, nieuwe lane.

- Tess

Oké. Hebben jullie veel ad-hoc zendingen, zo last-minute van, ‘dit moet nu in een keer nog geregeld worden’, of is het veelal gewoon op bijvoorbeeld een halfjaar basis, dat je weet dat je het komende jaar dit en dit één keer per week moet gaan shippen. Of heb je ook wel in een keer van, dit moet nu in een keer volgende week verscheept worden?

- 27:23 – 28:18 Manager

Het grootste deel van wat Company XX doet, zijn vaste lanes. En dan hebben we natuurlijk ook een heel pakket aan kleinere klanten, waarbij we dat eigenlijk kunnen schalen in ad-hoc. Dat zijn die exotische zendingen wat je zegt, komt eens in de 3 maanden voor. Er zijn bepaalde klanten die echt maar 6 zendingen per jaar hebben. Maar ook voor die 6 zendingen per jaar, als die naar dezelfde bestemmingen gaan, dan hebben we daar toch wel een SOP voor afgesloten, of tenminste een werkinstructie voor gemaakt. Gezegd van, ‘oké, daar is het goed voor en zo is het geschikt’.

- Tess

Oké! Dan heb je al best veel van mijn vragen beantwoordt. Dan hier wat specifieke dingen, ik weet niet of dit dan in SOP staat of in een planning, maar je hebt bijvoorbeeld minimum acceptance time en connection time en transfer time, zijn dit belangrijke aspecten in farma?

- 28:56 – 33.04 Manager

Dat ligt er echt helemaal aan wat het is en hoe het verpakt is, wat de stabiliteit data is. Waar jij op doelt is, de grondafhandelaar, die wordt trouwens door de airline gekozen en niet door de freight forwarder, dus als wij zeggen, we willen met de KLM vliegen, dan gaat het automatisch naar de KLM grondafhandelaar, naar Emirates dan gaat het met Denata bv. Even over de tijden, de minimum acceptance time, dan heb je het echt vaak over, oké, de vlucht vertrekt om 8 uur en de grondafhandelaar zegt, ‘8 uur voor de vluchttijd moet de zending afgeleverd zijn’. Dat betekent dus dat we om 12 uur moeten leveren. Dat is eigenlijk niet meer dan dat. Wat je dan wel moet meerekenen is, wat is dan het risico dat we hebben van die luchtmaatschappij op deze lane. Misschien dat die grondafhandelaar geen opslagfaciliteiten heeft, of heel weinig. Nou ja, als het dan 8 uur buiten de koeling moet staan en de zending moet 2 tot 8 graden blijven, dan is dat iets om mee te nemen. Waar we ook heel erg op letten is de tarmac tijd, dus wat ik net al zei, de grootste boosdoener eigenlijk op het hele traject. Dus, hoe heeft de luchtvaartmaatschappij in combinatie met de grondafhandelaren, een operatie geregeld om te zorgen dat temperatuur-gecontroleerde zendingen zo kort mogelijk buiten op het platform staan? Dus blootgestelde ambient temperaturen, inclusief de tijd, het ligt een beetje aan de temperaturen, dat de zending opgebouwd moet worden op de vliegtuigplaat, want ze moeten wel vastzitten. Nou ja, hoe langer dat is, hoe groter dat risico is. Hoe korter dat is, hoe lager dat risico is. Dus dat is zeker iets om mee te nemen.

Maar dan heb je ook weer het aspect, en dat is eigenlijk de lastigheid van de materie. Op het moment dat wij de zending heel goed verpakt hebben, in hele goede verpakkingen, dan maakt het weer niet zo heel veel uit. Het zou kunnen zijn dat, ik wil niet altijd zeggen, maar het kan zijn dat die combinatie prima samengaat. Dat je zegt, 8 uur buiten de koeling, die verpakking moet dat makkelijk aankunnen, dat maakt helemaal niet uit. Dan heb je nog zoiets als transfertijd, die heeft eigenlijk exact met hetzelfde te maken. Dan heb je ook tarmac tijd, de tijd bij de grondafhandelaar. Want dan wordt het naar de grondafhandelaar gebracht en dan gaat het ook weer terug het platform op. Dus dan heb je eigenlijk twee keer tarmac tijden. En dan heb je nog zoiets als de totale transfertijd, dat wil niet altijd een ding zijn. Wel commercieel natuurlijk, de klant wil natuurlijk gewoon z'n product zo snel mogelijk hebben, maar het kan

zo zijn, en dat gebeurt vaak in de farmaceutische industrie, dat de zending is verpakt met een passieve verpakking die maar een x aantal tijd houdbaar is. Dus als je bedenkt dat jij naar het strand gaat met je koelbox met een paar koelementen erin, dat is leuk misschien voor een halve dag, dan blijft het netjes koel, maar als je 6 dagen later uit dezelfde koelbox nog probeert om iets te pakken, dan is het niet goed meer, dan is het wel goed opgewarmd. Hetzelfde geldt voor bepaalde verpakkingen. Dan is het wel belangrijk dat je binnen die tijd, een paar uur, 5 dagen soms, wel op plek van bestemming bent, dus dat de zending weer uitgepakt kan worden. Het kan zelfs zijn, en daar heeft Company XX ook een flink pakket aan klanten van, wel een beetje ongewenst, maar dat de binnenkant van sommige verpakkingen 2 tot 8 moet blijven, maar de buitenkant juist 15 tot 25, om de binnenkant goed te houden. Waarom is dat zo, er zitten bijvoorbeeld ijspacks aan de buitenkant, en als de zending dan te koud wordt opgeslagen, dan krijgen die ijspacks te veel energie en vriezen die eigenlijk aan de zending. Dan wordt de temperatuur te laag. Dus daar zit best een hele rekenkunde achter.

• Tess

Ze maken het niet makkelijk!

• 33:06 Manager

Ja, dat is inderdaad het geval, dat is ook waar denk ik de meeste freight forwarders en klanten wel mee struggelen. Dus dit is een flink web aan dingen. Gelukkig zijn er verschillende IT specialisten, waar volgens mij Validaide ook mee werkt, die op basis van die stabiliteitsdata en op basis van de data die Validaide oplevert over het risico, over de lane risk assessment, om het zo maar te zeggen, daar een berekening op loslaat en zegt, ‘dit is je meest goedkope maar betrouwbare verpakking’. Dus daar zit een calculatie in, hoe ze dat exact doen, daar ben ik nog niet helemaal achter, maar tot die tijd doen we het eigenlijk toch wel heel erg manueel.

• Tess

Oké! Dan had ik nog een paar vragen over grondafhandelaren, want over de tarmac tijden en ook wie dan eigenlijk op de airport staan en zo. Hebben jullie daar informatie over of is het meer van, de luchtvaartmaatschappij kiest een grondafhandelaar en die moeten maar zorgen dat ze de instructies kunnen volgen? Of is het wel echt, jullie hebben daar ook nog een handje in?

• 33:30 – 38:54 Manager

De grondafhandelaar is wel echt een heel ander interessant onderwerp in de pharma industrie, omdat, je zegt het goed, wij kiezen in principe de grondafhandelaar niet. Ook niet aan de overkant, want we kunnen hier wel zeggen, we hebben Emirates en die heeft een contract met een fantastische grondafhandelaar, Denata, die heeft alles perfect voor elkaar, maar dan komt het uiteindelijk aan de andere kant van de wereld ergens aan bij een grondafhandelaar die het niet snapt. Dus hoe behandel je dat dan? Wij doen dat eigenlijk tweeledig, en nogmaals, ik zeg ‘wij doen dat’, omdat dat echt een onderdeel van de risicofactor is. Onze eerste instelling is eigenlijk, een grondafhandelaar is eigenlijk een vendor, een aangewezen outsource product, door de luchtvaartmaatschappij. De luchtvaartmaatschappij maakt een contract op met de

grondafhandelaar, dat doen wij zelf niet. Dus wat wij controleren is, hoe controleert de luchtvaartmaatschappij hun vendors, dus hoe monitoren zij dat? Want zij zijn eigenlijk verantwoordelijk. Hetzelfde als wat ik moet doen voor de luchtvaartmaatschappij, en wat ik moet doen voor die cross-docking agent of handling, mijn eigen loods, en wat ik moet doen voor die wegtransporteur. Dat moet ik ook controleren en dat zijn allemaal mijn vendors. Die grondafhandelaar daar doe ik direct geen zaken mee, dus dat is niet mijn vendors. Dus we hebben gezegd, als we de lijn van de GDP volgen, dan moeten wij de luchtvaartmaatschappij auditten op basis van hun vendormanagement. Dus wij controleren, oké, hoe doe je dat? Hoe vaak controleer je dat het goed gaat, hoe houd je bij dat ze temperatuurexcursies hebben gehad, bijvoorbeeld? Wat doe je daarmee? Dat is eigenlijk de grondslag, nou hebben we wel min of meer, omdat dat het lastige is, dat een luchtvaartmaatschappij heel goed vendormanagement kan hebben, zij maken niet even goed inzichtelijk, ze doen het wel maar niet altijd even goed, voor een boeking, of de lane compleet geschikt is voor farmaceutische goederen.

Een voorbeeld daarvan, Emirates, omdat het een hele grote maatschappij is, die doet volgens mij bijna 200 bestemmingen aan. Maar zij hebben niet alle 200 ground-handling agents, zoals jij het noemt, goedgekeurd voor farmaceutica. Dus zij denken, ‘ja, we hebben bijvoorbeeld ook een ground-handling agent in Duba, ik zeg maar wat, die snapt amper productvracht is, dus die heeft al helemaal geen farmaceutisch goedgekeurd product om het zo maar te zeggen. Nou noem ik een extreem voorbeeld, maar die voorbeelden zijn er ook in beter ontwikkelde landen. Nou is Emirates nog een airline die het redelijk goed inzichtelijk maakt, maar we hebben genoeg airlines, bijvoorbeeld Aeroflot, die elke bestemming die zij aan doen, publiceren als ‘dat is goedgekeurd voor pharma’. Ja, dat kan gewoon niet. Dus wat wij wel doen, is op lokaal niveau, op onze grootste bestemmingen, de grondafhandelaar ook apart controleren. Dus we hebben gezegd, die zijn goedgekeurd als grondafhandelaar. En dat willen we eigenlijk in de toekomst meer gaan combineren, dat hele gebeuren, daar is Validaide ook vrij recentelijk voor aangesteld. Wij willen dat in Validaide systemen meer gaan consolideren van, oké, volgens onze bevindingen, wat wij gezien hebben, zijn deze lanes inderdaad geschikt om te gaan gebruiken. Dat is momenteel nog niet helemaal goed ontwikkelt binnen Company XX, want als wij zien, oké, de GHA XX is goed in Amsterdam, maar hoe doen ze dat nou in Nieuw-Zeeland, ja, je kan niet verwachten van iemand die in Amsterdam zit, dat die weet hoe dat daar in Nieuw-Zeeland gaat. En er zijn hele grote freight forwarders die dat wel gedeeltelijk hebben ontwikkeld, maar zelfs daarvan zien we nog, en dat horen we dan van klanten, dat dat ook vaak nog fout gaat. Dus het hele product is inderdaad vrij ingewikkeld.

• Tess

Oké, maar als je het dan bijvoorbeeld over verantwoordelijkheid hebt, stel dat een van die luchtvaartmaatschappijen zegt, ‘dit is pharma geschikt’ en dat is het niet, ligt dan de verantwoordelijkheid bij jullie?

• 39:12 – 39:39 Manager

In principe ligt de verantwoordelijkheid, als zij het inderdaad hebben verkocht als pharma geschikt, dat kan zijn he, ook waar mensen werken, worden wel eens fouten gemaakt. Al heb

je alle procedures 100% goed uitgeschreven, dat het toch fout kan gaan. Heel soms gebeurt dat nog wel eens. Dan is de luchtvaartmaatschappij in dit geval aansprakelijk, ook al gebeurt dat bij hun vendor, dus de grondafhandelaar. Dan is de luchtvaartmaatschappij aansprakelijk.

- Tess

Oké!

- 39:52 – 41:15 Manager

Laat me een ding daaraan toevoegen, het is natuurlijk wel belangrijk dat de freight forwarder en de klant rekening houdt met de ambient temperaturen waarin de vracht zich in bevindt. Dus wat we ook heel veel zien, en daar wordt de luchtvaartmaatschappij nogal gek van, is dat mensen dan 2 tot 8 gaan versturen zonder verpakking. Uiteindelijk wordt die zending korte tijd, misschien een half uur bijvoorbeeld in Dubai, 45 graden, en dat de forwarder dan gaat gillen tegen de luchtvaartmaatschappij en zegt, ‘ik heb 2 tot 8 geboekt en dat is het niet’. Dat is een grijze gebied, alleen kan de luchtvaartmaatschappij die verantwoordelijkheid dan weer afschuiven en zeggen, ‘wij vinden niet dat we verantwoordelijk zijn, want jij hoort rekening te houden met ambient temperaturen’. De moeilijkheidsgraad ligt ‘m echt heel erg in dat elke luchtvaartmaatschappij en elke grondafhandelaar zijn eigen procedures heeft, zijn eigen lengtes aan tarmac tijden, en niet alle luchtvaartmaatschappijen, ook de grote luchtvaartmaatschappijen, hebben niet allemaal goed inzichtelijk hoe dat nou zit, op welke bestemming. En daarnaast is het ook nog zo dat wat wij dan goedkeuren voor de ene, als je bijvoorbeeld een A-product bij Emirates koopt en een A-product van Lufthansa, dat daar ook nog een heel groot verschil tussen kan zitten, in wat dat inhoudt.

- Tess

Ja, want hoe weeg je dat tegen elkaar af?

- 41:18 – 42:22 Manager

Wij hebben verschillende Service Level Routines gemaakt bij de luchtvaartmaatschappijen, waar we ook hen vastbinden aan bepaalde tarmac tijden bijvoorbeeld, dat is altijd nog het meest risicovolle onderdeel van de keten. Op het moment dat wij dan zien op de data logger, van ja, jullie zijn daar overheen gegaan, jullie hebben een langere tarmac tijd gehad, we zien dat de zending langer is blootgesteld aan deze temperaturen, dan hebben we alle recht om te vragen, kunnen we ze altijd verantwoordelijk houden daarvoor. Dat hebben we overeengekomen, we hebben dat eigenlijk een beetje naar ons toegetrokken, om te zeggen van, ‘jullie kunnen daar niet duidelijk een antwoord op geven, dat snappen wij, maar wij willen wel weten waar we aan toe zijn’. En dat, die informatie nemen we dan ook mee met de risicoanalyses die we dan maken.

- Tess

Oké! Dat is wel logisch. Een van de laatste vragen, want jij hebt al best wel veel ervaring, vooral in air freight en dan nu ook wel in pharma, zou jij ervaring, dus jouw ervaring, als een fundamenteel ding zien van het forwarden van shipments in pharma?

- 41:55 Manager

Ik begrijp de vraag niet helemaal. Als die fundamenteel zou zijn, dan zou ik hier denk ik niet zitten.

- Tess

Want mijn baas zei dat van heel veel freight forwarders boeken ook gewoon omdat zij weten van, Chicago naar Rome werkt wel en dit werkt niet, omdat ze dus al zo lang in de wereld zitten.

- 43:25 – 45:27 Manager

Ja, dat is een grote, ik snap je vraag nog niet maar ik zal er wel commentaar op geven. Ik denk dat je daar wel de zere punt een beetje oplegt, ervaring, en de macht der gewoonte, is denk ik in de hele luchtvaartindustrie en misschien zelfs in de hele logistieke industrie, wel een groot ding. Je ziet dat mensen toch niet elke keer de SOP gaan lezen, die gaan niet elke keer, ook al veranderen wij wat, die gaan het niet lezen. Dus wat wij moeten doen is dat wij hun actief duidelijk maken dat er iets veranderd is voor een bepaalde lane bijvoorbeeld. En dat is eigenlijk deze gewoonte herkennen, daar gaat eigenlijk de hele farmaceutische GDP-industrie over. Gewoontes durven herkennen, zwaktes, of gevaren, kunnen zien. Het is een gevaar, een risico, wat jij beschrijft, dat mensen door hun ervaring maar altijd hetzelfde blijven boeken. Dat proberen te doorbreken door je procedures daarop aan te stellen. Dus wat wij wel kunnen doen is bijvoorbeeld zeggen, ‘nou ja, prima, degene die verantwoordelijk is voor die risicoanalyse, daar stopt het niet’. Wij kunnen niet zeggen, we hebben een SOP veranderd en dan is het klaar, in de lijst wordt opgenomen dat de freight forwarder, de operator, dat altijd moet lezen. Nee, wij weten dat dat in de praktijk niet werkt, of niet goed werkt, we kunnen er ook niet vanuit gaan dat als mensen elke dag dezelfde zending hebben, dat ze maar elke dag die SOP erbij gaan pakken of die werkinstructie erbij gaan pakken om te kijken of er wat veranderd is. Daarbij moeten wij wel actief naar die mensen toegaan en degene die dat veranderd heeft, die dat heeft kortgesloten, daar toestemming voor heeft gegeven, actief er naartoe gaan en ook laten ondertekenen, ‘ik heb deze verandering naar de kennisstal genomen’.

- Tess

Ah oké!

- 45:33 – 46:45 Manager

Het is dus echt een stukje document control en change control. Change control staat ook in het GDP-regelement beschreven, als je die regeling leest, dat dat echt een onderdeel daarvan is. Dat geldt aan alle kanten, dat geldt ook al zou je zeggen, we willen een keer een andere vendor gebruiken bijvoorbeeld. Wij stappen over naar een andere wegtransporteur. Dat we dat dan wel

ook vastzetten daarvoor. Als wij zouden zeggen, dat heeft de luchtvaartmaatschappij een tijdje gemeten, wij doen ook metingen bij luchtvaartmaatschappijen, dat we dat een tijdje hebben gemeten en we krijgen de resultaten daarvan terug, dan zeggen we, ‘nou, die servicelevel agreement waarin zij zeggen, 30 minuten tarmac tijd, platformtijd, dat is eigenlijk in praktijk 1,5 uur’. Ja, dat is dan een te groot risico, dus dan gaan wij kijken naar de klanten, de lanes die wij hebben, wat zou dat dan voor verandering kunnen brengen? En dat is dan ook een verandering waar we op moeten acteren, actief moeten overbrengen naar het personeel.

- Tess

Oké! Dan heb ik mijn vragen allemaal wel gesteld. Ik heb nog een vraagje, dat gaat dan ook over het project, een bachelor student die werkt ook voor dit project en die zoekt eigenlijk websites of data, alles wat over de air freight gaat, daar moet zij een soort van informatiebundel van maken. Weet jij toevallig nog websites die niet zo voor de hand liggen zijn?

- Manager

Goede vraag. Zo snel even niet. Wat je wel kan doen, kijk je meer algemene sites kijkt, of bedrijven?

- Tess

Beide

- Manager

Embaliso, die heeft op hun website bijvoorbeeld vrij sterk staan, hoe zij bepalen wat voor verpakking zij gebruiken, en hoe dat bepaald wordt. Dan heb je een beetje kennis daarvan.

- Tess

Dat zal ik even doorsturen! Dat wil je heel erg bedanken voor je tijd, en het beantwoorden van mijn vragen.

Transcription Interview 2

- 0:00 – 1:12

The first part of the interview, Tess introduces who she is, what she's doing and giving a brief explanation about the LARA project, stand for Lane Analysis & Route Advisor, and aims to digitize and optimize Lane analyzation of the special Cargo in the planning phase. Special cargo means all cargo that requires special handling such as Pharma and life animal. Tess' part is to structure the knowledge of the planning phase of special cargo, because it's nontransparent and all over the place, and hard for machines to comprehend. She's building a sort of like a vocabulary for machines to understand the special cargo.

- 1:13 - 1:45 Tess

In order to do built such a vocabulary, I need to know about the about the domain, so that's why I'm interviewing you and I'm very glad that you could make some time for very grateful for this opportunity. My first question is, what is your profession, what do you do?

- 2:02 – 4:18 Director

My name is Name Surname, I am the director of XX based in XX, been working with Company Y for the last 13 years, in various roles and positions. In this role for the last 5. I had a break in between with Company Z, and then went back to Company Y. Been working with pharma for the last 10 years, so really my entire business career was pharma, and developing the requirements of customers coming on board, and then implementing that for the transportation environment. Right now, we're managing roughly 25.000 shipments in a team of 50 people, roughly, located here. We roughly have 74 (or 47) customers, in depo. It's not distribution, to the final customers, like to the apotheker. It's going from one depo to another depo. Or to intermediate steps for production. If you look at a pharmaceutical, if you look at one drug, one pharma products, it gets produced and researched all over the world, before it actually gets finished into a pill, or tube. It goes around the world at least 5 to 8 times. So, there's many production facilities, and many sub-production phases of pharma. And active pharma ingredient, is where certain companies are specialized in, and in one aspect of the manufacturing process. Everyone is outsourcing many little things, because they can't do it themselves. And this is where we help, this is the playground where we play. Where we move large doses, large quantities around the world, in various temperature-controlled environments.

- 4:23 - 4:35 Tess

Is there also involvement in the production process?

- 4:36 – 4:49 Director

No, we don't get involved in this at all. We are a transportation company.

- 4:50 - 5:10 Tess

I would also want to know a little bit about your background. Like what was your studies? And how did you get into pharma?

- 5:10 – 6:18 Director

I studied here in Country X, as a dual system. So, the bachelor finished for transportation, logistics and supply chain. And I had a company sponsoring me, Company Y back then or "natra". They sponsored me for 3 years, for me to go to UNI, and then in between uni, I was working for them in various departments, so I could go to into every function of the company. And then I actually did an exchange semester in NL. International management, where I could do a double agree, and finished of a degree there as well. 2007 I finished up, and then straight into operation, as a freight forwarder, and starting to build up packaging requirements for the transportation. That's what I first started doing, that's when I met Eelco

as well, around 2008. He was still working at another company, Antaris. That's where we started our first business together.

- 6:36 - 6:38 Tess

So you go back, way back.

- 6:44 - 6:49 Director

Exactly. And then we've been developing all these packaging Solutions and transportation solutions for customers for the last 10 years.

- 6:53 - 7:09 Tess

Okay, I guess my first formal question is if you would to summarize your main job in two sentences, how would you do that if it's possible?

- 7:20 - 8:18 Director

We are like a “conductor,” you know, like the central officer. Like in a symphony you have many participants, it's a big team. Everyone has their own role, that's the transportation chain. Our role is to coordinate everything and bring it all together, to make it sound like and sing a perfect symphony. So you have many stakeholders, airlines, packaging suppliers, transportations companies, etc. So we have none of that, we find the best practices for all of them, and bring them together, and provide the customer one solution. End-to-end. Bit more than 2 sentences, but I think you get it.

- 8:19 - 8:35 Tess

Yes I do, thank you. So you are also more in the planning or more in the operational side? Because you have to arrange everything, so that would be the planning of the whole process, but are you also in checking up on the goods, or maintaining?

- 8:37 - 8:40 Director

So, our teams are responsible for planning but also executing.

- 8:44 - 9:16 Tess

Okay, thank you. Both okay.

So, what do you think? So, if you have a shipment of pharma, and you have to go over like for the next half year, a shipment every week. I don't know if that's generally possible. But for this example, what are the most important parts that you need to consider when planning this shipment?

- 9:21 - 10:39 Director

Foremost, temperature, right? The other aspect is speed and its' physical route. These two inputs are the most vital. And then you work backwards. So, depending on what the temperature requirements are.

As a side note, we handle every shipment ranging from -150 degrees Celsius, -80, -20, 2 to 8, 15 to 25, and plus 30. These are the 5 bandwidths, 5 temperature areas, and all that requires totally different packaging and different requirements. So, depending on what your product is, any product is different, that's when we work backwards. That's when we start looking. Of course, the route is also important. So, then we start looking what are the best packaging provider for that temperature, where is it going to and from, do we have the necessary infrastructure there for that packaging. And then, you start cancelling things out, you start going down the list.

- 10:40 - 11:00 Director

What's the most important parts? Pff, it's to have the right partners place. We don't have anything ourselves, because we are the freight forwarders, so we need to have the right partners at the right location.

- 11:00 - 11:50 Tess

What I've been bumping into lately, it that there is quite some information available from Airlines and stuff, but it's very non-comparable. Sometimes it's a bit all over the place. At least that's my experience. Do you have certain partners that you often repeat the same process with? or do you check every time like okay wait, we have all these partners. Let's cancel down or do you start from the beginning with every partner that you have, or every airline that is out there?

- 11:51 - 12:45 Director

So you need to differentiate between air, road and ocean. If we only look at air, we have a small pool of approved suppliers, or carriers. We have a quality service agreement with them in place, this is basically limited to 13/14 carriers. And then, with those 13, there is actually 5 within that 13 that are handling 80/90% of our volume. So with these 5 carriers, you can actually get to every place where pharma is being transported, at least to 90%.

- 12:51 - 13:45 Tess

Small side note, I'm mostly focusing on airfreight, so airlines and such. But I didn't know this, this is great information. Let me see, so.

So, you said that you start with these 13 carries, if it would be airfreight. And then mostly these 5 airlines you focus on, these have the most shipment. So then, you have a route that you decided, and you have packaging. I guess you also have to think of warehouses, or are these already standard, or do you also have chosen different warehouses?

- 13:49 - 14:48 Director

The process is, let's take a real-life example. Chicago to Rome, Italy. A route, so ideally. I would first look at my top 5 to 13 carriers, are there any direct flight, that would be number one. Then I quickly find out that there are no direct flights from Chicago to Rome. Then I go back to see what the alternatives are, to which airport could I potentially go, which is closest to either one of the origin or destination airports. So, there is an American flight from Philadelphia to Rome. So, then it would go from Chicago to Philadelphia to Rome. I also start looking at other options, from Lufthansa for example. Chicago - Frankfurt - Rome. But then Frankfurt – Rome, it would be trucked by Lufthansa, I know this. That is a very long distance from trucking, nearly 2000 km. And then we start looking at all the other alternatives based on routing, time, how quick it can go and what is the least risk for the product.

- 15:19 - 15:24 Tess

So, the risk factor, is that gut feeling, or do you have certain calculations, or is it that you know that trucking 2.000km is too long, let's not do that. Or is there information on that? Or assess it yourself.

- 15:49 - 16:45 Director

So, we use the Validaide of course, as a tool. But we're freight forwarder and we've been doing this business for many, many years, and we know exactly without a software what is feasible. This is part of our DNA, to select the best. I have my symphony; I select my best people to play that certain transport play. So, I know exactly which one I need to use when, for that type of business. This is our added value right. I can of course use a platform as support, to validate my decisions process. It reconfirms it.

But yeah, you have a good freight forwarder, they know exactly what they're doing, and what is the closest and then they can do it. This is part of the training and experience that comes to the table.

- 17:17 - 17:36 Tess

What do you think is the hardest task in planning for a pharma shipment? I guess you have to make some compromises, and risk is also a variable. But are there other parts that make it hard for pharma to make a routing plan?

- 17:46 - 18:30 Director

Things move, things change without you knowing.

Simple, small things that can change, that could have major impacts. That is one of the hardest parts, to stay on top of everything. If you want an example, there just aircraft change by the airlines, the aircraft is smaller than it was previous. You want the shipment to get on it, but you can't due to physical restrictions. Things like that. But these are often on exotic routes, that are not as heavily frequented.

- 18:34 – 18:47 Tess

So, capacity can also be, especially last-minute changes in capacity, can be quite hassle.

- 18:47 – 19:15 Director

Well yes, or the airline changing their setups, for specific routes. Meaning they could the ground handling agents, at the destination airport, which have a major impact. They then don't have the capabilities they had previous, or they have it only on paper and can't actually do it. Things like that.

- 19:15 – 19:20 Tess

Ah okay. I do have some questions about ground handling, but I'll get back to that. So, you already gave some great examples that I really find useful, but could you perhaps give me another very typical, where everything went according to plan? No last-minute aircraft changes. Perhaps in the of the last month or so?

- 20:13 - 20:54 Director

Yeah, it was a scheduled as booked as planned to the right time with the right flights with the right temperature, that I booked with airline, arrived at the right time. Customs were submitted on time, the picked up was scheduled on time.

- 20:56 - 20:59 Tess

Customs, that can be a bottleneck or is that not your experience?

- 21:05 - 21:06 Director

Sure, it can, but it doesn't need to be. With correct preplanning, with customs, you can mitigate many things. Making sure that they know things are coming. Making sure quantity is correct, before shipping. The planning part is vital for customs. If you have poor planning, you have poor performance of customs. There is a direct relationship.

- 22:01 - 22:23 Tess

So, what is the most reoccurring flaw in the pharma process, that will makes a shipment either fail or delayed?

- 22:27 - 23:20 Director

One is capacity, when things are getting offloaded, but I think the biggest thing is people not following instructions. The cargo is being handled by so many people and it's to make sure that everyone in that chain has the latest information. That's probably the most difficult part. You can ride the biggest or the best SOP, have the best instructions. But if that person who is touching it, doesn't know what he's doing or isn't trained on it, it's nearly impossible. Based on the weakest link, it will fail for sure. Just move on box from the Basel to somewhere in the

US, there are probably at least 50 or a hundred people touching them. Just the put it in perspective.

- 23:21 - 23:26 Tess

Okay, so if they all need to know what they're doing otherwise ..

- 23:32 - 24:30 Director

It could be that one person, who is picking cargo up from the airport, who thinks "this is something else". We had it just recently. The shipment was a -20 degrees with gel packs, with cooling element inside. He thought a dry ice shipping, -80. He opened the Box and refill the dry ice, and it got to cold. He was trying his best thing, he did it all the time, but for this shipment, it was the wrong one. We had trainings in place, but yeah.

- 24:22 - 24:33 Tess

So packaging can be messed up in anyway, that is for pharma vital right? If it's too cold, it won't work anymore.

- 24:34 - 25:36 Director

Yeah, exactly. So, the container is the vital element to maintain the temperature. So here, if its preconditioned wrongly, not prepared correctly, that's a weak link, or risk factor. Critical control point, that needs to be controlled. But of course, the packaging behaves in a certain way when its exposed to ambient temperature or other temperature. If that get put into the wrong channel, where other temperature gets exposed, it behaves different inside.

- 25:10 - 25:36 Tess

Could you tell me about a very unusual case where either everything went wrong or something last minute or you had to, I don't know, run every corner to make the shipment. Could you perhaps give me an example of that?

- 25:46 - 27:27 Director

It happens many times, that the planning element is not given enough importance, sometimes even on a customer side, not necessarily our side. We get triggered by a customer, what to do. If they have poor planning, then that decreases our time to plan the shipment. This happens quite often actually, that we only have a few hours to organize a very large shipment, and this creates stress on many frontiers. That's where you have to cut corners.

For instance, we just had it last week, we had an active cooling unit, from Copenhagen to the US, and we planned it correctly, did a couple of checks with the container. And then we got to the customer and the display of the container was broken, it failed by technical reasons. So, we had to arrange an exchange and it was a Friday. And there was traffic everywhere in Copenhagen. The replacement was hard, people were on sick leave. Just natural elements that adds to the complexity.

- 27:28 - 27:31 Director

So the biggest thing (*Hinder*) is time and people.

- 27:39 - 28:09 Tess

You said this was last-minute planning, that you have a few hours to fix a route and everything. But there's also like sort of biddings, especially on kind of big shipments that you have to compete with other freight forwarders, or is that not what Company Y does?

- 28:10 - 28:55 Director

Yep, because this is more towards larger tenders. That bidding aspect is not on per shipment basis, it can be for general cargo, but not for pharma. For pharma, this is not on a transactional basis, or shipment basis, but more for long term contracts, for 2 or 3 year deals.

- 28:55 -29:00 Tess

That would mean the shipper would always go to this freight forwarder for the shipments, or is it only certain shipments?

- 29:10 - 29:55 Director

They, the customers, tender their business onto the market, and quote their business. And then we bid for it, and then they select one. Then they say “you are the primary new carrier for the next 2 or 3 years” and then, we sign contract, they order us. And we make sure that we are all on the same page. Then they have one or two carriers for that business, but that can change. Normally one customer always has two or three or even four suppliers.

- 30:14 - 31:31 Tess

Okay, let's see. So, to come back to the process of planning certain shipments, for example Chicago to Rome. Do you have preference one route of another? Like you must maintain temperature of course. That's the most important part. I guess, I answered my own question there. Yeah, I think there's a lot of questions for you that you already graciously answered.

- 31:37 – 32:31 Director

It also comes down to commercial right, so when you go on your vacation right? When you use skyscanner. You look at the different flights, and you go “Okay. Well, this one takes 10 hours and this one takes 25 hours with 3 stops, but it is 800 bucks cheaper.” The more transit points, the less quality you have, for the cargo. It is very similar to passenger travel. And then the direct flight, if there is one, is the more expensive one. And then need to talk your customers, “well okay, what are you willing to pay for it” or “are you willing to pay for something there is a better quality, or are you willing to accept a longer lead time for a cheaper rate” so they tell us right.

- 32:31 – 32:54 Tess

so it's not that you make your own decisions on like a we do with the right fight, even though it's expensive. You keep in contact with the customer and like what do they want? It's not that you make all the decisions.

- 32:57 - 33:24 Director

Well, it's a little bit of both, they give us clear instructions, like we only want direct flight, or we don't care, it needs to be cheap. It really depends on the customers. And the commercials that agreed with them, or it is per shipment basis. Because they have customers on the backend as well. It really depends on what are the requirements. That drives many decision processes afterwards.

- 33:32 - 34:03 Tess

So, there's definitely a difference between certain customers on what their needs are. So, you did mention Validaide for basically backing up your decision making. Are there other tools or other software programs that use to either back up or make decisions in the planning phase of pharma?

- 34:08 – 35:22 Director

Yeah, so we of course use all the flight routes which is part of an online platform, flight routes from all the carriers. On the web pages of the carriers, there is one source actually OAG flight schedule. OAGflight.com, something like that. Like a summary of every possible flight out there, registered flights pulled together. That and container providers, where their network is, where their stations are, where you can pick up containers. We use many tools, of course excel to do our own risk assessments or WORD to write SOPs and write things together.

- 35:22 - 35:31 Tess

For the containers, do you check that online, or do you have a software for that, or is it online/on webpages.

- 35:35 - 35:41 Director

We have a transfer management system that pulls by the EDI connections with all the carriers. But ultimately, we can also go directly onto their webpages, of the carriers.

- 36:01 - 36:08 Tess

So what did you say about the slide there was OAG schedules?

- 36:08 - 36:12 Director

It was just a provider, to link it all together.

- 36:30 - 37:03 Tess

Another example, if you would have a shipment and all have direct flight I don't know if that's possible. but how do you make a choice between for example active container, passive containers, dry ice compared to gel packs, is all that related to the temperature, or are there also needs from the customer involved? How do you make choices in, for example packaging?

- 37:04 - 38:30 Director

Foremost, the customer and product, who decide that. The product meaning, what are the product requirements. You have very sensitive goods, and not so sensitive goods, that will dictate what type of solutions you will use, what road you will go down. There are some products that are quite stable in the makeup of its physical components, molecules than we can use the cheaper version. Everyone is trying to save money on, right? Some are very important to the customers business, clinical trials, they need to have a very strict temperature control. That will dictate more expensive, and active container solution, versus rather than using a passive solution. It really depends on the price, the budget of that product. Of course, the temperature as well. Certain package can serve in a certain temperature range.

- 38:36 - 38:55 Tess

So, you mentioned earlier, that airports can change ground handling agents, but how do you know which airport has which ground handling agents and which capabilities?

- 38:57 - 40:10 Director

We have a very high-level agreement with the airline. Here we have specifications what are our requirements are, when we book with them. They need to make sure that their handling agents fill these requirements. So, in essence, I've given them the responsibility to make sure that they have these capabilities. When we place the booking, if their capabilities do not fulfill the booking, it is up to their responsibility, to tell us, for this nation we cannot accept this cargo, because XYZ. But in reality, yes, they sometimes accept freight where they don't have the full requirements, and things go wrong. But then we use this platform such as Validaide to identify these ground handling agents, to create our own view of the performance of the ground handling agents.

- 40:10 - 40:47 Tess

But in essence, if it is an air carrier would accept a shipment that they can't handle basically, it's their responsibility. So, if it goes wrong, it's their responsibility

- 40:57 - 41:02 Director

Exact, but I'm still getting the complaints of the customer, so it is in my interest to reduce the number of cases where things go wrong, because I don't want to constantly explain myself. There will be a time where I lose credibility, towards my customers. "You're using the wrong type of container or airlines"

- 41:07 - 41:07 Tess

So. It's the best thing if it all just go smoothly in the air carriers can handle it. Of course.

- 41:11 - 41:12 Director

So, in essence. You don't actually have the information, perhaps indirect, about the ground handling agents at hand. But through the air carriers you either do or don't unless it's not up to par. Like if you would book a shipment, and you just give your needs, you don't necessarily know what the ground handling agents are capable off. Unless they are not capable of fulfilling your needs, right?

- 42:00 - 42:46 Director

Yeah, and ultimately it is still responsibility. I'm buying something from them. Like when you book a ticket with Lufthansa as a passenger. I want to travel first class, so I'm willing to pay 2.000 euro for the ticket and your expectations are that they going to have the VIP service in Frankford and where you are traveling to. Like a lounge, priority for your baggage everywhere, and then of course you don't get it, you start complaining right.

- 42:47 - 42:49 Tess

It is very comparable, sometimes, to customers flights, to my flight experience.

Transcription Interview 3

- 0:00 - 0:59 Tess

Introductie over haar scriptie en het project LARA waar zij aan mee werkt, dat dit over het digitaliseren van special cargo gaat. En dat zij hiervoor mensen interviewt om de kennis te structuren zodat machines dit kunnen begrijpen. Ook een korte uitleg hoe dit interview bevat
Daarna vraagt ze Head Manager wat zijn baan inhoudt en hoe zijn loopbaan eruitziet

- 1:59 - 2:58 Head Manager

Head of Pharma and Healthcare bij Company Z. We zijn momenteel bezig op het opzetten van een afdeling, of we hebben hier nu een afdeling voor. En daar ben ik verantwoordelijk voor. Elke dag is verschillend qua werk, maar ik ben verantwoordelijk voor de ontwikkeling van het pharma network binnen de organisatie van Company Z. Dus ik hou me bezig met bijvoorbeeld suppliers, Validaide die op gesprek komt, voor risk analyse van de trade lanes die we hebben. Maar ook suppliers van passive and active packaging. En samen met onze business development manager Richard Peil, doe ik dat soort zaken voor klanten. En daarnaast zijn we binnen Company Z aan het kijken voor meerdere certificeringen van CEIV certification van de GDP. Die hebben we hier op Schiphol behaald, en die willen wij wereldwijd uitrollen over ons company Z netwerk. We hebben over de wereld 660 locaties en dan willen we op de keypunten

ook certificaten behalen, zodat we weten dat de cool chain intact blijft, zodat de goederen op de juiste manier aankomen.

- Tess

CEIV, is dat alleen voor luchtvaart?

- 2:59 - 3:54 Head Manager

Ja klopt, die is eigenlijk voor alle deelnemers binnen logistiek van luchtvracht. Dus trucking companies, forwarders, ground handlers en airlines. CEIV staat voor Center of Excellence for Independent Validators in Pharmaceutical Logistics, dat is vanuit de IATA ontworpen zodat de cool chain gesloten blijft. Dus de deelnemers die deze certificering hebben, moeten ook aan de juiste eisen voldoen, allemaal gebaseerd op de GDP-richtlijnen hier binnen Europa. GDP staat voor Good Distribution Practices. Dus zeker als je met farmaceutische middelen te maken hebt, is het belangrijk dat je de goederen op de juiste manier afhandelt. Specifiek voor temperatuur gecontroleerde goederen. Want als medicijnen niet op de juiste temperatuur zijn, kunnen ze gevaarlijk worden voor patiënten. Dus we proberen op te vangen door ontworpen netwerk van IATA, en zo veel mogelijk certificaten te krijgen.

- Tess

Als ik het correct heb, jij doet zelf niet de boekingen van pharma shipment, maar meer de ontwikkeling daarvan?

- 3:59 - 4:57 Head Manager

Ja klopt.

- Tess

Zou je wat kunnen vertellen over jouw achtergrond in logistiek, maar ook in het algemeen?

- Head Manager

Ik ben iets meer 2 jaar geleden begonnen Company Z, als managementtrainee in Ocean. Dat heb ik anderhalf jaar gedaan, en een jaar heb ik bij business process supportteam gezeten hier op school. Die zijn bezig met procesoptimalisatie van het proces van boeken, bij het invoeren van systemen etc. En daarna ben ik na een jaar op de pharma afdeling gekomen, om daar eens te gaan kijken hoe het daar allemaal zit. En na een half jaar om de functie te accepteren als head of pharma and healthcare. Daarvoor helemaal geen achtergrond in supply chain management, ik heb zelf hoge hotelschool gedaan in Amsterdam. En eigenlijk wilde ik graag een traineeship doen, toen kwam ik Company Z tegen, ingeschreven, en zo is het begonnen.

- Tess

Kleine switch dus wel! Dan heb ik nog wat vraagjes over het plannen dan van de boekingen, want daar gaat mijn onderzoek over. Er zijn dus meerdere spelers die deel uitmaken van het pharma planning process, wie zou jij als belangrijke spelers bestempelen binnen dit proces? Bijvoorbeeld een vliegvaartmaatschappij.

- Head Manager

In het geval van pharma, en zeker temperatuur gecontroleerde goederen, zijn de 3 belangrijkste partijen, de trucking, de ground handler en de airline zelf. Het begint bij het trucking, want het belangrijk dat de goederen in de juiste truck worden opgehaald, in de juiste temperatuur condities. Zo'n trucking bedrijf moet ook aan de juiste condities voldoen. Dus als het tussen de 2 en de 8 graden moet zijn, en er heeft bijvoorbeeld vis in gezeten, dan kunnen wij zo'n truck niet gebruiken. Dus het moet dus echt een pharma dedicated truck zijn die tussen de 2 en 8 graden moet kunnen leveren. Daarna heb je de ground handling agents (GHA), dat is waar wij de meeste moeilijkheden zien. Daar wordt het toch heel vaak niet in de juiste cellen wordt opgeslagen. Het kan bijvoorbeeld heel lang op het tarmac staan, waardoor de temperatuur excursies voorkomen. Dat is dus het lastigste bij GHA, omdat we daar ook niet heel veel over kunnen zeggen, en hebben we ook geen invloed op als freight forwarder. We doen ons best om in de communicatie duidelijk te maken wat wij willen, maar alsnog merken de forwarders dat daar de grootste kruk zit om temperatuur gecontroleerde goederen bij de GHA te hebben staan.

- Tess

Want de vliegtuigmaatschappijen gaan eigenlijk over deze GHAs toch? En staat ook vast toch?

- 6:59 - 7:59 Head Manager

Ja klopt, bijvoorbeeld KLM gebruikt Denata, dus als wij bij KLM iets boeken, weten wij dat Denata onze GHA zal zijn. Dan weten we ook dat die goederen op de juiste manier worden opgeslagen, omdat zij ook de juiste certificaten hebben, zij hebben ook CEIV-certificaat behaald, dus dan weten wij dat zij bepaalde processen volgen, die in lijn liggen met CEIV.

- 7:59 - 8:58 Tess

Ah, en dat duidt dan aan dat het closed cool chain blijft. Ik had ook nog een vraag, want ik hoorde dat er verschillen zijn tussen freight forwarders, op het gebied van afspraken hebben met airlines. Sommige hebben dit wel, en sommige niet. Hebben jullie ook zon contract of agreement dat jullie altijd met bepaalde airlines of verschilt dit per shipment of lane?

- 8:59 - 9:58 Head Manager

Ja dat is heel erg afhankelijk van de lane natuurlijk, die wordt gebruikt. Bij pharma is het preferred, 9 van de 10x om direct te vliegen. Dus bv Amsterdam naar Bangkok, je kunt bijvoorbeeld met Lufthansa, die bijvoorbeeld geen directe vlucht hebben, en een transit station in Dubai heeft. Waarvan je weet dat er temperatuur excursies kunnen plaatsvinden. Dan vlieg je liever met KLM, want die hebben een directe vlucht Amsterdam – Bangkok, dus dan heb je de minste kans op temperatuur excursie op een tarmac.

En we hebben net zoals alle freight-forwarder contracten met airlines, block space agreements bijvoorbeeld. Wij willen die ruimte in dit vliegtuig op deze lane, die willen wij dan standaard hebben. Er zijn verschillende contract vormen met airlines die wij gebruiken hiervoor.

- 9:59 - 10:20 Tess

Block space agreement? Oké! Iets specifieker over problemen, want ik had vernomen dat het moeilijk is om onderscheid te maken tussen de producten, Lufthansa heeft bv pharma plus, KLM heeft pharma plus. Allemaal verschillende producten op bepaalde lanes. Hoe maak je het onderscheid, of de keuze van product? Of heeft directe vlucht voorrang op het product?

- 10:20 - 11:58 Head Manager

Zoals bij een directe vlucht heeft meerdere producten die een airline aanbiedt. Je hebt bijvoorbeeld pharma product maar ook perishables, je hebt 2 tot 8 maar ook 15 – 25 graden. Het hangt heel erg af van de goederen die je stuurt. Dus wij krijgen opdracht van een farmaceut, zij zeggen dan wij willen graag dat deze goederen tussen de 2 en 8 graden blijven. Dan geven wij de farmaceut een aantal opties waarvan wij zeggen “oké, of we hebben een directe vlucht, dat kost een x bedrijf” of “we hebben een transit in Dubai, dan is het bedrag soms wat lager maar dan heb je een groter risico op temperatuur excursies”. En hangt het ook nog af van de airline of zij ook die services bieden, want er zijn genoeg airlines “we hebben geen 2 tot 8 graden ruimte op deze vlucht op deze lane”. Dus ja, moet je naar alternatieven gaan zoeken. Dan ga je eigenlijk alle airlines af tot je er eentje gevonden hebt, en dan ga je daarmee vliegen.

- Tess

Oké! Maar als ik het dan goed begrijp is het wel dat de farmaceut uiteindelijk zegt, van dit wordt het. En niet dat de freight forwarder de keuze al maakt?

- Head Manager

Nee dat klopt, wij als freight forwarder zoeken naar de meest optimale keuze voor de farmaceut. Die leggen wij voor. Wij proberen altijd met twee opties te komen, als die er zijn. En de laten we de keuze aan de farmaceut om te zeggen “ik neem het risico, ja of nee” daarin faciliteren wij slechts, als freight forwarder. Dus meer een adviserende rol.

Het is natuurlijk een beetje prijs afhankelijk, want stel je voor je dan een direct vlucht dan betaal je 4 euro per kilo, en indirecte vlucht is 1.30. We bieden ze beide aan, en dan gaat de farmaceut waarschijnlijk ook zeggen van “oke, hij kan indirect vliegen, en dan zorg ik wel voor een passieve verpakking die goedkoper is”. En dan leveren wij de passieve verpakking, en dan proberen wij daar aansluiting op te zoeken.

- Tess

Het is dus wel echt wat de klant wil, en wat van prijs daar natuurlijk aanhangt voor hen. Maar is de prijs altijd per kilo altijd?

- Head Manager

Naja, de prijzen komen per kilo binnen luchtvracht. Dus als je vliegt 2 ton, dat is dan de chargeable weight. Afhankelijk van het volume, daar betaal je over. Dan bieden we uiteindelijk een totaalpakket aan, met een totaalprijs aan. Dus ook met afhandelingskosten, GHAs trucking companies etc. Als we het totaal plaatje inzichtelijk hebben, daar komt 1 prijs uit, en dat communiceren we naar de klant.

- 12:59 - 13:58 Tess

Jij zei net ook dat je op een gegeven moment, stel Lufthansa heeft niet de 2 tot 8 range die je wilt hebben, dat je dan net zo lang zoekt tot een goede?

Is hier een soort van protocol voor, of is het websites afgaan?

- Head Manager

Daar zijn handige tools voor, die wij hier gebruiken. CargoGuide is er een. Een website met meerdere airlines. Daar kunnen wij zeggen van wat zoeken wij nou precies, wij zoeken naar deze lane, deze service en dan krijgen we daar een x aantal airlines uit, of juist helemaal geen airline uit. Dan weten we ook dat het niet bestaat op zo'n moment. En dan zijn er een aantal platforms waarop wij kunnen zoeken, om het inzichtelijk te kijken.

- 13:59 - 14:55 Tess

Dan heb ik nog wat specifiek vragen, want op operationeel niveau heb ik vernomen dat bepaalde experts op hun vakgebied zeggen 'ik boek altijd deze lane met deze service, want ik weet dat het goed is'. Maar zou jij zeggen dat ervaring, op operationeel niveau, belangrijk voor het uitvoeren van de functie als freight forwarder?

- 14:59 - 15:59 Head Manager

Ja absoluut, je hebt ervaring met airlines met bepaalde vluchten positief of negatief. Als je bijvoorbeeld een route hebt waar veel fouten zijn, dan gaat er een preventive action plan in, dus stel je voor, je hebt een zending 2 tot 8, die worden met een normale truck vervoerd, van Parijs naar Amsterdam, en dan komt 6x voor. Dat is nogal een dingetje. Iemand met ervaring ziet dat snel, die weet dan, dit kan niet. Het is zeker om aan de freight forwarder, met de juiste ervaring om de juiste keuzes te maken. Als het vaak fout gaat, heeft iemand met ervaring dit snel door. Dit is ook een beetje de taak van de freight forwarder, om de supply chain goed te laten lopen. Dan liever een andere airline gebruiken bijvoorbeeld.

- Tess

Dat is natuurlijk de extra value die een freight forwarder dan levert aan de klanten. Nog een andere vraag, is het belangrijk want van voor vloot een luchtvaartmaatschappij heeft? I

- 15:59 - 16:58 Head Manager

Ja, in zekere zin wel. Binnen de pharma zijn we daar niet heel afhankelijk van, dat zoeken we niet daadwerkelijk uit. Maar we hebben bijvoorbeeld een programma, PROGRAM X. Dit is een project om de CO₂ uitstoot te reduceren. En daarvoor is het van belang dat we precies weten welke toestellen op welke lanes vliegen, omdat het ene toestel meer verbruikt dan het andere. Zo kunnen wij ook aan onze klanten de groenste optie leveren. Daar is Company Z een van de eerste freight forwarders in, wat de groenste optie is om te vliegen op het gebied van cargo shipment. Wij bieden nu een x aantal lanes aan, waarvan wij kunnen laten weten wat de groenste optie is.

- Tess

Dit is inderdaad de eerste keer dat ik dit hoor!.

- 16:59 - 17:55 Head Manager

Er staat ook op YouTube een filmpje waar het wordt uitgelegd, dat zou je eventueel kunnen opzoeken.

- Tess

Die ga ik even opzoeken! Voor PROGAM X is dus de vloot wel belangrijk, welke aircraft. Dan heb nog vragen over afkortingen. Als ik zeg SPH, hebben jullie dezelfde termen? Dat kan verschillen onderling tussen freight forwarders, hoorde ik.

- 17:59 - 18:59 Head Manager

Dat is inderdaad het verwarringe binnende logistiek, iedereen gebruikt voor hetzelfde een andere afkorting. Wij hebben nu een andere afhandelingsnaam.

- Tess

Gebruiken jullie SPH? In bijvoorbeeld SOP of in de afhandeling van de goederen?

- Head Manager

Ja wij gebruiken zeker speciale afhandeling, zeker voor temperatuur gecontroleerde goederen. Wij hebben onze eigen loods, op schiphol. Die zit direct aan de luchthaven, aan de landingsbaan. We hebben de mogelijkheid om goederen heel snel te ontvangen of te versturen, als we het hebben over hele platen. Daar worden die platen in de loods opgebouwd, afgebroken, op de juiste temperatuur gezet. Als het een pharma shipment van 2 tot 8 is, en er komt een hele plaat binnen, dan weten ze precies dat ze die moeten in de 2 tot 8 graden ruimte moeten zetten. En daar zijn allemaal verschillende codes voor, die ze moeten gebruiken om precies te weten wat waarnaartoe gaat.

- 18:59 - 19:59 Tess

Dat is dan alleen jullie eigen loods, dus niet zo zeer voor GHAs?

- Head Manager

Nee, dat is meer wat wij binnen deloods doen, wat ik ervan weet in ieder geval.

Dus wij krijgen ook vanuit de GHA, dat zijn natuurlijk ook kosten, die gaan via de airline, als ik het goed heb.

- Tess

Stel, er worden fouten door de GHAs gemaakt, bij wie ligt dan de verantwoording? Ligt die dan bij jullie? Of ligt het dan via de airline?

- Head Manager

Dan kijken we vaak eerst naar de airline, wat er fout is gegaan. Want die hebben het contract met de ground handler. Dan laten we een in cat procedure beginnen waarin we precies zien wat er fout is gegaan, en hoe kunnen we dat in de toekomst voorkomen, en welke acties worden er ondernomen om dat in de toekomst te kunnen voorkomen.

- 19:59 - 20:58 Tess

Dus eigenlijk is de vluchtvaartmaatschappij verantwoordelijk?

- Head Manager

Ja, die zetten het natuurlijk ook door naar de GHA, en uiteindelijk is de GHA eindverantwoordelijk. Want die maakten op dat moment de fout.

- Tess

Ik las laatst een artikel, met stability data of medicine. Is dat ook iets waar jullie mee werken? of is dat jullie niet focus, of niet belangrijk voor jullie?

- 20:59 - 21:55 Head Manager

Uiteindelijk is het belangrijk, want het is belangrijk voor de farmaceut. Maar dit is meer aan de kant van de farmaceut zelf, om dit zelf in te zien. Wij zijn geen farmaceutisch bedrijf, dus wij doen hier ook geen studies op. Wat wij wel doen, is de temperaturen loggen. Dus als het een temperatuur gecontroleerde zending is, en er wordt gevraagd om data loggers, dat die mee worden gestuurd. Dan zijn wij wel op de hoogte van de temperatuur gedurende het transport. En deze informatie wordt van bij de ontvanger, bv een apotheek, die lezen dit soort berichten uit. Die kunnen dan kijken aan de hand van die data, of de medicijnen nog goed zijn. Dus als het een 2 tot 8 product is, en het is 1 uurtje 15 graden geworden, dan is het vaak dat de medicijnen nog gebruikt kan worden. Dat is nog te overzien. Maar als het medicijn 10 uur op 40 graden had gezeten, dan kan de ontvanger zeggen ik wil het niet meer verkopen, want het is gevaarlijk. Die hebben alle data erachter want die kennen het medicijn door een door. Dat is niet onze expertise. Wij spelen hier slechts een adviserende rol in. Wij zeggen dit is de data die we hebben. De conclusie die eruit wordt getrokken doet de farmaceut zelf.

- 21:59 - 22:59 Tess

Wellicht is dit niet helemaal jouw expertise, maar wat vind jij belangrijke delen of aspecten in het plannen van special cargo shipments? Bijvoorbeeld, temperatuur is voor medicijnen heel belangrijk, zoals je al zei.

- 22:59 - 23:57 Head Manager

Dat is een algemene vraag, het hangt echt van de goederen af. Het allerbelangrijkste is de communicatie. Dat wij precies weten wat er speelt of welk moment, daarvoor zijn wij een forwarder, dat willen onze klanten ook weten. Dus mochten er bijvoorbeeld goederen niet vliegen omdat er een label verkeerd is geplakt, of andere zaken zijn die niet goed lopen, dan draait het heel erg om de communicatie. Dat wij meteen op de hoogte worden gebracht, zodat we toch nog op tijd kunnen vliegen. En deze informatie dat komt van de GHA zelf, dat zijn hele belangrijke spelers voor ons. Met name de mensen in deloods, dat zijn onze eyes and ears, die zien alles wat er gebeurt. Die handelen met de goederen. De plakken labels, etc. Dat zijn een van onze most important assets, die mensen die de zendingen boeken maar ook de mensen die de zendingen door hun handen heen krijgen.

- 23:59 - 24:10 Tess

Je moet natuurlijk ook kunnen reageren op de veranderingen die er zijn. Want wat zijn de grootste struikelpunten die verkeerd kunnen gaan op zon pharma zending.

- 24:11 - 26:15 Head Manager

Met name temperatuur excursies, voor temperatuur gecontroleerde goederen. Dat is de grootste bottle neck. En dat ligt voornamelijk op de tarmac, en dat het door de GHA te lang op de landingsbaan staan. Of dat het niet goed gekoeld wordt, niet op de juiste plek wordt weggezet. Waardoor er temperatuur excursies ontstaan. Dat is de grootste bottle neck, binnen temperatuur gecontroleerde goederen

Ik zou trouwens aanraden, om op youtube een filmpje te kijken. CEIV PHARMA, dat is een hele introductie video, dan zie je ook precies wat de losses zijn in de markt van pharma. Ik weet bijvoorbeeld dat 35 miljard binnen de pharma industry gaat verloren, en daarvan is bij 30% de logistieke sector de schuldige, waarbij de logistiek niet goed omgaat met de goederen, waardoor er dus bijvoorbeeld temperatuur excursie plaats vindt. Daar gaat ontzettend veel geld in om, en geld verloren. Daar is dat IATA label vandaan gekomen, die zeggen "we willen die cool chain zo kort mogelijk houden, en zorgen dat iedereen aan bepaalde procedures voldoet" dus ze hebben wereldwijd een standaard gecreëerd, en als je daaraan voldoet, krijg je een certificaat, dan weet je ook dat de goederen op de juiste manier worden afgehandeld.

Desalniettemin, worden wij ook geacht om al die partijen te auditeren. Dus wij gaan ook naar de airlines toe, naar GHA toe, en dan gaan we kijken hoe zien de processen eruit. Waar zijn jullie koelruimtes, voldoen die ook aan wat wij hebben afgesproken met IATA. En als dat allemaal goed is, dan worden zij goedgekeurd als een van ons preferred supplier. Wij hebben een X-aantal trucking bij Company Z, waarvan wij zeggen, die zijn door de audit heen

gekomen, die voldoen aan de eisen van Company Z, en van IATA of GDP, want GDP is eigenlijk leidend. Dan zeggen wij, we gebruiken deze 3 speciaal voor pharma.

- 25:15 - 26:19 Tess

Wat is het specifieke verschil tussen GDP en CEIV? Is GDP Nederlands of?

- 26:20 - 26:59 Head Manager

GDP is Europees. Bij USA is het FDA, Federal Drug Agency, Azië heeft ook een andere. Dat zijn dus steeds andere instanties. Sommige GDP worden dus bijvoorbeeld in Nederland door de IGJ uitgegeven, in Luxemburg is het een commerciële partij, zoals SGS. Daar geeft SGS de GDP-certificaten uit. Het zijn echt richtlijnen, iedereen kan de richtlijnen anders interpreteren. Dus toen heeft IATA gezegd, we doen 1 label, IATA CEIV label. Daar halen we een heleboel punten uit GDP, die nemen we over. En die maken we wat specifieker zodat je precies weet waar je dan niet aan kan voldoen.

- 26:59 - 27:56 Tess

Dus wel vergelijkbaar maar ook weer niet?

- Head Manager

GDP is echt regionaal, en de CEIV is internationaal bepaald.

- Tess

Een praktische vraag even snel tussen door, als je jouw baan, in 2 tot 3 zinnen moeten omschrijven, als dat lukt, hoe zou je het dan omschrijven?

- Head Manager

Het opzetten van pharma en Healthcare afdeling binnen de Company Z organisatie met de focus een wereldwijd netwerk binnen de organisatie.

- 27:59 - 28:58 Tess

Kort maar krachtig, dank je! Ik had ook nog vragen over warehousing, maar jullie hebben dus een eigen loods. Nog een vraagje betreft GHAs, je hebt in principe de informatie niet, maar je zei ook dat je (soms) audits doet. Want dat zijn preferred suppliers, wat je zei?

- Head Manager

Soms heb je niet echt een optie. Maar het is natuurlijk handig om te weten, wie voldoen aan onze eisen, en wie niet. Als wij pharma goederen willen versturen, dan moeten wij wel zeker weten dat zij ook aan bepaalde eisen voldoen die wij van onze klant ook krijgen. Dus daarom hebben wij bijvoorbeeld bij Denata een audit gedaan om te kijken, zijn die conform, handelen ze naar de regels, met de producten op die manier. Dat is voor ons van cruciaal belang. En dat

wordt ook vanuit IATA, vanuit het CEIV-certificaat, geacht dat je zelf de audits doet, zodat je zeker weet de partijen die mee doen, gecertificeerd zijn, en op de juiste manier hun goederen afhandeling doen

- 28:59 - 29:57 Tess

Er zit dus wel verschil tussen verschillende freight forwarders, want ik heb vernomen dat de freight forwarder zegt van dit is niet onze verantwoordelijkheid, dit ligt bij de airline. Dus wij gaan geen audits doen, wij doen audits op de airline, en dan moet het maar goed. Maar jullie gaan er dus echt zelf naar toe?

- Head Manager

Ja wij gaan er echt zelf naar toe. Wij willen echt de garantie hebben dat het goed gaat. We kunnen wel alles aannemen, maar dat is niet echt onze baan. Wij staan echt voor kwaliteit en garantie daarvan. Dat is binnen de pharma net wat gevoeliger, dan bijvoorbeeld voedsel. Ook qua kwaliteit, is het net wat belangrijker. Het allerbelangrijkste voor farmaceuten die pharma verschenen is de kwaliteit.

Transcription Interview 4

- 0:00 – 1:41 Tess

Tess introduces herself, her study (*MSc Innovation Management*), her thesis, and the LARA (*Lane Analysis and Risk Assessment*) Project with its participant and its goal, which is to digitize and optimize lane analysis of special cargo (defined as all cargo that is not general, e.g. pharma, perishables, etc.) with a focus on the planning phase. Her part is to gather and fully understand the knowledge about this domain and structure this so human as well as machines can comprehend the knowledge.

- 1:44 - 2:26 Product Manager

I'm working here at Company B now for four years. I'm in the process department and I'm actually responsible for pharmaceuticals, perishables. I'm not really working on day to day problems, I design the processes for overall, as well as quality of these processes.

- Tess

So, what is your main task?

- 2:44 - 3:26 Product Manager

The core of it is, I would say, 80 or 90% of my role is pharmaceutical. And I guess what I am really responsible for at the moment, is ensuring these product (QUALITY)

So, we have three products at Company B, that we promote for pharmaceuticals shipment. One called Celsius active, which are active containers. We have Celsius passive solutions, which

are the advantages packaging solutions, like our case it is Va-Q-tec. We do leasing on these kinds of products. And finally, we have our Celsius Passive, which is basically just standard shipments, we also store these shipments in proper temperature-controlled environments. So, on the booking, there is a temperature code, usually associated with the pharmaceuticals. Not all pharmaceutical is temperature controlled, but most is. If you have instruments, sometimes medical instruments fall under pharmaceutical, but they're not under temperature.

- Tess

Ah yes, they don't need to be 2 to 8 or something like that.

- Product Manager

We try to be very aligned with IATA's standard. So, I mean we use the standard PIL code, pill code, to designate all our pharmaceutical shipments.

- Tess

Are you the person that design services or products?

- 4:32 - 5:30 Product Manager

So, we have people who get the user requirements. And they give me the requirements and then I will turn them into processes. Now I'm trying to avoid having a thousand processes, that's not practical for anyone to work with so. I mean, as I mentioned, we have three main processes. Most things will fit in one of those three categories based on how you book your shipment. And then as well, we do have some specific lanes and customer specific processes also defined. You know, if someone wants to have a special icing, re-icing of a container or need a special check sheet, that isn't our standard sheet that we use through a cool chain, then we would create a special process.

- 5:32 - 6:21 Tess

So, I did see process manager as your title, but it is very clear now what that entails.

- Product Manager

It is the how we do it. And we ourselves, as an airline, we don't actually do the work ourselves. All of our handling agents, the work is outsourced. Our people do the initial booking of a shipment, we might order the container if there being leased on behalf of our customers but then basically the process is meant for handling agent to use as a reference guide.

- Tess

So, your customers would be the freight forwarders then, or also the pharmaceutics companies?

- 6:21 - 6:29 Product Manager

Freight forwarders, we do talk to shipper occasionally of course. But as a rule, we work with our Forwarders. The forwarder are our customers.

- 6:31 - 7:13 Tess

Okay, so yesterday I spoke with a freight forwarder and he says there's two types of bookings, like sometimes that they contact you, and sometimes that they say "we just want this". So a normal booking, versus when they have different requirements, and then you as an airline apply your knowledge to it, and say 'this is what you need'. Do you experience that the same?

- 7:19 - 7:34 Product Manager

I can imagine, out in the out stations, that they

I think the freight forwarders, especially the big ones, know what they are doing. And I mean, basically they look around at the different airlines, and they say "okay, I need someone to move my Va-Q-tec box, or I need someone to move my Envirotainer Box". I think generally speaking we are all doing it in the same way, to be quite honest.

- 7:47 - 9:46 Product Manager

We try to have some value-added Services of one sort or another. And maybe we'll make us more attractive as an airline to choose, but in the end, it will often come down to, what routing I am at, what routing am I, what routing does the shipment have. I guess I would usually choose the one that has the most direct route to avoid a lot of potential brakes in the cool chain. And of course, you know to be realistic, price is always an issue, in who you're going to choose right? But I think the way we handle, if you look at one of the big handling agents, like here in Switzerland we have a big company called Cargo Logic, who handle sort of 80% of the Company B, Airport, they handle probably 25 different airlines. We can't really start changing things too much, for our own expectations. They won't put the white gloves on if they are handling one of our boxed. To be realistic, of course, we have user unique selling points. Some of our products, we can offer, as an example, with the active tracking service, we don't rent the devices out, but we do allow our customers to book tracking devices on the aircraft. The special handling code that we have defined for that, then they are allowed to contact 7 by 24 Celsius Operation Center, who will assist them if they have an x temperature excursion or something is seen on their log, this team will help them and try to solve the incident right away. As an example, with Va-Q-tec, it is an advanced passive packaging. You put these cooling packs inside, and they will hold within the box for up to 5 days. You can choose your temperature range from +20 to -60. They use different types of these PCM, Phase Change Material modules, that they insert inside of the boxes. These act the same way as packs that you can freeze, that you put into your cooler, to keep your beverages nice and cool in the summer. It is more sophisticated, but it is the same idea, you line the inside of a Va-Q-tec with all of these PCM. This will hold the temperature.

- 11:47 - 12:07 Product Manager

But what can happen, it last for 5 days, if you have like a 2 to 8 shipment, it has traveled for a day, and then it has performance time "How much time is it still going to hold the temperature" in this case the 5 degrees inside. If you now put it into a cool room, at the same temperature as that phase change, in a sense the clock stops there so you can buy yourself another day of

cooling. And this is Va-Q-tec doesn't actively say that, they say "rent the box it's good for 5 days".

- 12:12 - 13:11 Product Manager

One of our value-added services is that we will put the box always into cool room or whichever is possible. If we don't have a freezer large enough to put them in, we can't. That's another thing I'm responsible for... We have a web page where you can see all the capabilities of the different station, so I'm also responsible for maintaining that, maintaining the database so that you can see "okay, if I want to go Singapore to Zurich to Miami, I can look and see what facilities are available in each of those stations. And I can know, if I have to move to two square meter or a 4 square meter box, there is a big enough cooler or whatever all along the Route".

- 13:12 - 14:10 Tess

That's also part of your job? Okay.

- Product Manager

So, we are a CEIV certified airline, and I'm sure you're aware of that certification right now. It's a GDP compliance certification, and I'm responsible here for maintaining that for Company B.

- Tess

That's also one of my questions. How does your company in to deliver extra value? But that's also the CEIV, and the active tracking?

- Product Manager

We have additional cooler capacity or whenever possible to extend the life these kinds of packaging.

- 14:19 - 14:34 Tess

So, you said that sometimes you have to make a manual process, based on one of the main 3. What are aspects you consider in the modified processes?

- 14:45 - 19:25 Product Manager

I'm thinking out loud. I can give you a good example. When we do active containers, like an enzirotainer, and their customer still wants to use dry ice in a container. A company envirtainer have, what they call, a dry ice calculation sheet. And what they will do then, they will plan from start until the end, including maybe a transit point, they will calculate the total amount of hours that you need to transport the box from A to B. how long does it sit at B, maybe it has to stay there 8 hours to connecting flight, and what temperature will the box be stored at in the air craft, in the transit area, and the second aircraft, and maybe it has to stay in a room for a day

for custom clearance at the end destination. Then this dry ice calculator will figure out how much ice you need to add to this container for this entire distance. We have some customers, that have shipments that need to be really, really cold. So, they will add ice to the container as well. In an example, a customer wanted that when the product arrives in Zurich, they want us to break to seal, open the container, and add x amount of additional ice. They will request on the airwaybill how much extra they want to have put it.

We will do that for them, here in Zurich, as a special process. We will write that process, that customer agrees, they set the requirements of what they want, we get the OK from our ground handler agent. Normally you can't start opening containers and add ice, especially without permission. We don't need to get customer permission first to open it, because they already have given it, by way of this special process.

Another example, sometimes we ship cryo vessels, they are temperature -70 or -80 degrees, they come from Asia, they come to Switzerland, and sometimes they go onward to America or Basel. While the container is waiting in Zurich for its connecting flight, because it could 12 hour, or even if its 7 or 8 hours, just to help or added an extra layer of protection or to reduce the risk of a temperature excursion, we will store that container in a cold room. Whereas a norm like active container, envirotainers, we will just store a normal warehouse. Which will preserve the ice better. This is another example of a process.

We have our standard operation process; this is the cream on top.

- 19:26 - 19:41 Tess

And I guess this is all dependent on the product, right? Whether they want more modified process or not?

- Product Manager

Yes

- 19:45 - 19:54 Tess

You also mentioned you did perishables and animal, what would you say is the biggest difference between making products, but also the requirements from the customer? Because you said pharma is 80% of what you do.

- 19:57 - 20:12 Product Manager

Well, financially pharma is probably 90%. The time I spend, maybe 80% pharma, maybe 10% perishable, 10 % AVI.

- 20:14 - 20:22 Tess

So, what would you say is the biggest difference between those shipments or those services?

- 20:23 - 20:41 Product Manager

The names that I gave you originally, are maybe a little bit misleading. We call them Celsius active, Celsius Passive. The thing is, there isn't even the word Pharma in that. You can use the same products for perishables just as well. So, let's say, we don't really have a product called pharma. We have a product called Celsius Active, which happens to be 95% pharmaceutical. But you could use the same process with a perishable, or with a perishable fish, or sea food. Or strawberries. If you wanted to do that, you could do the same. Probably you wouldn't just from a cost perspective, use an active container to move fruit. Otherwise your strawberry would cost you 40 dollars.

If I was doing an airwaybill, I will use the PIL code to designate as pharma. We have our Celsius passive product, which it isn't Pharma product but it's you know, 90% used for pharma. We have our PIL code, and we have temperature. So, COL 2 to 8 degrees. There may be some additional things, time critical aspects, we also use our Espresso code in there as well. It has a fast transit time in Zurich, or it is delivered last minute at the acceptance station or origin station.

- 22:44 - 23:36 Tess

These codes, those are the SPH codes, the special handling codes?

- Product Manager

Correct, yes

- Tess

Are these only used on the air waybill or also on other instructions?

- Product Manager

Well they will be on the airwaybill. What also will happen, is when we accept, especially pharmaceutical, we have an IATA check, a time and temperature check sheet which will be used. And so, at that point in time, the person's actually checking that the air waybill, let's say we have COL, that there's a label on the box that says it should be put in temperature-controlled storage at the label and airwaybill, are these matching? You would like to see that you don't have two temperature codes. Sometimes customers put on two codes on by mistake. If there is a mismatch, then our shipment has to be stopped.

- 23:55 - 24:46 Product Manager

It has to be clarified with our sales department. What exactly do they want? So, it hopefully will travel the rest of the way, without any issues. And I guess, to add to that, especially at our hub, it is really important because that handling, what will happen, that temperature code COL or COT, that is entered electronically into the handling agent system. And then what we have is it sort of a computerized automated warehouse, and just based on that code, that's where it

goes up into the storage areas of the warehouse. That code will determine if it's sitting in the correct temperature storage. There is no human intervention at that point

It is very important that they get right at the beginning, because that's how our handling agent at the hub put into temperature-controlled areas. They really rely on the information on the airwaybill.

- Tess

You did mention that at the acceptance gate and such, you mentioned espresso product, can this be combined with an active container? Or are these two separate things? That if you have one, you can't have the other?

- 25:55 - 26:49 Product Manager

No, no, it's sort of like a pizza, with toppings. You can add espresso, you can add the temperature, the PIL. I guess where we are heading to, that the PIL code designate that it is a pharmaceutical product, so it should fall under the special rules we have with handling pharmaceutical. For example, we like to say our pharma LIFO, last out onto the tarmac, and first into warehouse afterwards, to minimize the temperature exposure to the outside.

We are really actively promoting, that shipments are logged properly, inbound and outbound of cool rooms, so that we really get a better transparency. When we do have a complaint after the fact, we can go back and say "at 14:03, it was loaded off the aircraft, and at 15:05, it was put into CRT room, COL room, or the frozen room, and it stayed there for 4h23m. And then it was taken out, it was repacked to be shipped onto the next flight" or whatever. In the pharma world, this is where the customer is driving for more and more transparency. So that they can know every minute where their shipments are. They very often, most of them nowadays are using data loggers of some sort. Either on the shipment, which is measuring how we are behaving, because you can see from a temperature graph very well if it was stored correctly. Did we get it out, at the designated time of 90 min after arrival? That after 90min it should be in the temperature-controlled room, in the warehouse. So, you can see easily see with those temperature graph, if we are fulfilling our SOP. Or rather the handling agents are fulfilling our SOPs. They act on our behalf.

So, this is this is a really important thing that's coming along. Especially pharma, because they are very much into minimizing any impacts, any temperature excursions too high, too low.

- Tess

I did see some presentation as well, that data and like transparency is becoming a bigger thing in pharma. Then I have some questions about ground handling agents because, you said they fall under your company.

- 29:18 - 30:11 Product Manager

Within pharmaceutical sphere, we have to do a risk assessment on every one of our handling agents and stations that carry pharmaceutical product. So, we will do a risk assessment based

on what facilities they have, also on amount of training that they have. Working with any of handling agents, we have a contract in place with them, of what expectations what they need to do for us. Filling out this document, or that they are able to move something from aircraft to warehouse in 90 min.

When we are doing an analysis for which handling agent we're going to choose, there is a minimum criterion of things that we expect. And subsequently within in pharma, we have about 60 stations that we move pharmaceuticals through, and we have done risk assessment on all of these stations. We broke it into 3 year cycles, so we do an audit of roughly 20 of those stations.

- Tess

What if, worst case scenario, they're not up to par anymore? That they underperform? Because often these ground handling agents are already at the airport. So what are then your possibilities to do?

- 31:02 - 31:51 Product Manager

That's a good question, because sometimes they have a monopoly, so you can't switch to another one. But to be honest, we're really having to do here is, I think, the introduction of the GDP best practices, that we use with our CEIV certification. It is very much working WITH our handling agents, and trying to explain to them, what the requirements are that we need. I mean the CEIV requirements are part of our contract. But of course, it's one thing to write it on a page, and it's another to live it. I try to work very closely to work with handling agents with audits. I don't even like the word AUDIT; I like to use the word 'compliancy check'.

In some stations, the compliance is probably 99%, and another stations, we have to go for low-hanging fruit, work on basics, segregating pharma from non-pharma in a cool room. Sometimes, you walk into a room and you see a big pile of wet mozzarella cheese, and it is sitting above a box of pills. This is kind of the worst-case scenario. This is where we want to make sure that they are segregating the two things apart from one another.

It is also things like, you have a cool room, did you map that cool room? If you didn't map it, are you going to map it? Are you monitoring the temperature in that room? What happens if it is too hold or too cold, is there an alarm? Does somebody walk around with a clipboard to write the temperature down every hour? There is nothing wrong with manual system, as long its document what needs to be done, and you can show me the records. If I come back to you 3 months later and say I have to do an investigation on this damaged shipment, tell me, you know, show me that you put this thing in the cooler and took it out at that time. It would be these kinds of things. It is very much about check, that you see they meet the timings. We'll check the timings on our handling agents.

The local station is responsible, if they fail the expectations. To make sure the handling agent is doing their job correct. But we are also watching it centrally.

- Tess

So, my next question would be like, what did you have a more basic GHAs? Do you adjust your shipment or process? E.g. a freight forwarder would book a route to Rome, but then you realize Rome does not have the 2 to 8 capabilities. Would you either urge the freight forwarder to say this is not possible, or to the GHA “step your game up”?

- 35:05 - 35:51 Product Manager

We would make sure that the freight forwarder is aware that there is no 2 to 8 facility in Rome. It comes down, if the station knows that it has fairly quick and efficient customs, if it gets dropped off, and it takes 3 hours, and the customer says I can take it 3 hours, that it's not in a temperature-controlled room so I can take that risk. That's part of what we also do in our risk assessment. The station, based on information and historical data that we have, we sort of rate those stations, 1 to 5.

You don't necessarily criticize. I guess we would look at the overall facilities and say okay. Maybe they don't have a cold room, or Frozen room, they only get a 4 instead of a 5. We might say that the risk is a 2 instead of 1. It will be a little bit high risk. You can work with that risk; you can mitigate it in different ways. Maybe you say to the customer, instead of a passive packaging, maybe you would want to upgrade to a passive solution. So that your box has like the little Vac-Q-Tec.

- 37:03 - 37:48 Tess

Exactly. So, you said that if the ground handling agents are not up to par, you can either fix it by packaging or like in other ways. But on the other way around, with certain processes, are they built on the value of certain ground handling agents? Because you said the one in Zurich was really good. Can you buy an offer extra value to the freight forwarder because it's so good or is that not of how it works?

- 37:55 - 38:55 Product Manager

I mean, again, as our hub, yes. They themselves have a GDP compliance certificate and CEIV certification, so they are sort of as good as it gets. We still do audits on them; we still find things that aren't right. Everybody makes mistakes. We handle 1000s of shipments every day. We are lucky in that sense. I am currently still doing the complaints, we do roughly 4.000 pharma shipments a year and we have an error rate. I think I did 150 complaints last year, so that's under .5%.

- 38:55 - 38:56 Tess

Yeah, that's not a lot of.

- 39:05 - 39:43 Product Manager

I also think that's very good. Of course, we like to get it down even more, if possible. You know we try to address those things, with our CAPPA reports and investigations. And we come

up with corrective actions. Sometimes it's at a process level, it's only at a station level. Maybe there has to be some re-education done. Maybe we have to build a special procedure, just for that station, to put a mitigation action that we don't want use everywhere.

- 39:49 - 40:08 Tess

Okay! I think I have one more question. What, in your job or in your task, what would you find the biggest bottleneck?

- 40:15 - 41:11 Product Manager

I think it is temperature control, and I think our customers are getting very sophisticated with the technology they are using, data loggers, or real time tracking devices, to monitor their shipments. And I think, we have to try to stay with them, we have done quite well. I, myself, have done a lot of extra to understand this technology and work with it as much as I can.

- 41:15 - 42:05 Product Manager

Basically, I can see almost down to the minute how you handled my shipment. So, we have to be aware, that there are eyes always watching us. We have to raise the bar as much as possible. We have to spend a lot of time just trying to help get stations that are maybe little behind the times and get them up to at least to the minimum standard, so that we don't have to worry so much about temperature excursions and things. I think the biggest thing is, it is the understanding of the importance of it. We are dealing with medicine, this can be people's life at stake. We have to take these things quite serious.

We need the support of our management as well, to give us the tools. And maybe you know, sometimes we have to invest a little bit ourselves, into improve things. It's always about cutting cost. But when it comes to this kind of stuff, you have to spend some money to get a good quality.

- Tess

Especially with medicine. Sometimes it's quality over price.

- 42:58 - 43:23 Product Manager

Same when it comes to animals, these are lives, we have to take extra care with these creatures. Compared to a plan for example, they don't feel pain. We try to have minimal time on tarmac, we use covered wagons when they are taken out of aircraft, that they are not left out in the sun. The temperature in the aircraft needs to be suitable for animal. In our case, we've done a lot of high-risk animals, dogs etc., we had a lot of problems with these animals, we cut out of the business, it was high risk for us, of having damage of social when something goes wrong. We shouldn't be encouraging these kinds of industries; these puppy mills of eastern Europe are quite brutal.

Transcription Interview 5

- 0:00 - 0:21 Tess

Oké want het is belangrijk om te weten wat van aspecten waar bijvoorbeeld ground handling agents ook in kunnen uitblinken maar dan moet ik wel al die aspecten weten en jij begon met dat je dus warhouse handling

- 0:24 - 0:26 Eelco En ramp handling

- 0:27 - 0:35 Tess

En warehouse, zou dan meer met trucs rondlopen en ?

- 0:35 - 1:17 Eelco

Warehouse is echt het warehouse, als je kijkt naar de flow. Er worden pallets worden afgeleverd in het vliegtuig, aan de ground handling agents op het vliegveld. Dat zijn gewoon houten pallets, daar staat dan cargo op. Maar dat is niet hoe het op het vliegveld vervoerd. Op het vliegveld worden ze op een ULD vervoerd, zitten ook weer variaties in, maar is meestal op een plaat. En dan worden er aantal pallets ook gezet en dan doen ze er een net daar overheen, zodat het veilig vervoerd worden in het vliegtuig.

- 1:18 - 2:05 Eelco

En die warehouse handling bestaat uit, eerst komt die truc daaraan, en dan worden pallets ergens in het warhouse opgeslagen. En dan vervolgens worden die ULD opgebouwd, en dat heet de ULD buildup. En dan pakken ze een metalen plaat en dan halen ze een aantal pallets en dan doen ze er een net overheen, of iets anders, of een thermo blanket, in ieder geval wordt die ULD voorbereidt.

- 1:18 - 2:05 Tess

Dat is wat ook dat filmpje dat je toen met de Lara meeting liet zien met rodin.

- 1:18 - 2:05 Eelco

Ja dat is dan voorbeeld van (airport) naar Irak. Daar zag je van die mannen die bezig waren met zo'n ULD buildup te doen. Dat is wat een warhouse handler doet, en dan is die ULD opgebouwd, en die wordt opgeslagen en die moet dan daarna naar het vliegtuig toe.

- 2:15 - 2:25 Eelco

En dan wordt ie dus met een truck uit het warhouse gehaald en dan naar een plek gebracht op het vliegtuig en daar wordt hij in de meeste gevallen neergezet tot het vliegtuig komt.

En dan doet die ramp handling, die rijdt rond met karretjes, zeg maar ook met koffers en die laat het vliegtuig in.

- 2:39 - 2:42 Eelco Dat is zeg maar proces.

Tess

Van de warehouse en ramp handling

- 2:48 - 2:54 Tess

Zijn er nog andere, naast warehouse handling en ramp handling of is het echt alleen deze twee?

Eelco

Nee dat is het wel.

- 3:00 - 3:23 Eelco

Je hebt wel natuurlijk twee kanten daarvan, de origin en de destination. Het gaat twee kanten op. het

wordt vaak als export en import gezien. Je hebt binnenkomende vluchten dan heb je het reverse proces.

[terugkomend op ULD, hoe dat eruit ziet, dat het er word ingeschoven, niet zomaar losse pallets maar wel samen gebonden, dat is veiliger].

- 3:23 - 4:05 Tess

Groundhandling agents hebben niet zo veel aan het digitaliseren toch van wat wij nu aan het doen, zij doen hun werk maar (meer operationeel dan digitaal)

- 4:08 - 4:09 Eelco

Laten we het zo zeggen, in validaide de capabilities zijn heel belangrijk. In het algemeen zijn die capabiliteit belangrijk. Wat er gebeurt er precies in die process stappen. En dan zijn dus.

- 4:11 - 4:33 Eelco

Jij richt je op de carrier services, dus die diensten die de Airlines aanbieden. En die zijn wel gerelateerd aan de capabilities van de ground handling agents, en soms kan dat best veel verschil maken. Er zijn wel elementen van die carrier services die gekoppeld zijn aan een specifieke ground handling agent.

- 4:36 - 4:43 Eelco

Een voorbeeld waar we het net overhadden, met die tarmac bypass. Dat is best wel een verschil tussen de ene Airline en de andere Airline terwijl ze wel gebruik maken van dezelfde groundhandling agent.

- 4:46 - 5:18 Eelco

Een ander aspect zie je bij Emirates. Die hebben bij Pharma twee services levels. Ze hebben Pharma en Pharma plus. En het verschil zit hem dan in de tarmac handing in Dubai , wellicht zitten er nog wat andere verschillen aan met cut off times of connection times, maar het voornaamste verschil is dus Dubai.

- 5:18 - 5:27 Eelco

Dubai is natuurlijk ook een mega groot airport en een hub. Er zit heel veel van en naar Dubai en dan gaat het door. En het is natuurlijk super heet in Dubai. En dat rondrijden, waar we het net over hadden, wat die ramp handler doet, en ook de storage op de tarmac voordat het het vliegtuig in gaat, er zijn dus middelen om het impact van het weer te verminderen.

- 5:32 - 5:37 Eelco

Je kunt natuurlijk die pallets rondrijden en in de zon zetten, maar je kunt het ook beschermen. Een van de middelen zijn Thermo blankets erover heen te doen

- 5:38 - 6:03 Tess

Terwijl hij dus in de zon staat te wachten

- 6:04 - 6:55 Eelco

Je kunt je natuurlijk ook afvragen wat er met die thermo blankets gebeurt als het in de Aircraft staat, maar dat zijn van die details, dat weet ik ook niet.

Maar een ander is dat er ook temperature control dollies of trucks zijn, dus dan heb je een soort van 'cool' vrachtauto en die 'cool' vrachtauto, die haalt het dan in de warehouse op en dan wordt het gewoon echt actief gekoeld, en dan blijft het in die cooltruck staan totdat het vliegtuig in gaat.

Tess

Dus eigenlijk gewoon geen wachten in de buitenlucht.

Eelco

Nee, dus altijd in principe is alleen of met van loading, dat je dan even voor het vliegtuig wat exposure hebt, maar het is een hele high level van bescherming die misschien ook wel nodig hebt in Dubai als je in de zomer om 14:00 daar aankomt.

• 6:58 - 7:23 Eelco

Dat verschil zit hem dus in een service die Emirates aanbiedt, dus in die zin is er wel een link aan een aantal van die eigenschappen of features, en de groundhandling agents, die er dus aan gekoppeld is.

• 7:24 - 7:37 Eelco

Bij Qatar bv, daar krijg je Standard bij hun Pharma service een temperatuur controlled dolly. Bij Emirates moet je dus een onderscheid maken tussen de normale Pharma services, waar je alleen een thermo blanket krijgt, en Pharma plus.

• 7:40 - 7:43

En alleen bij Pharma plus krijg die de temperatuur dolly

• 7:44 - 8:01 Tess

Wat is dan gegeven dat die groundhandling agents dat kunnen

• 8:02 - 8:37 Eelco

En daar wordt het nog moeilijker. In het geval van Emirates. Die doen hun eigen 'handling' daar, en Denate dat is van Emirates, en die zorgen er wel voor dat ze genoeg capaciteit hebben. dat ze genoeg van die temperature controlled dollies hebben. Want ze zouden het niet aankunnen als ze het niet zouden kunnen garanderen dat ze ook hebben

Maar ja, er zijn ook wel eens andere situaties dat het niet helemaal duidelijk is en of het mogelijk is om temperature controlled dollies te boeken een op een airport en dan ja, dat weet ik niet precies wat er dan beschikbaar is.

• 8:37 - 8:54 Eelco

Hoe je het dan precies moet boeken, er zijn situaties geweest, volgens mij in Milaan of in Brussel dat een Airport dan een aantal van die temperature controlled dollies koopt en die kunnen die groundhandling agents dan weer huren.

• 9:00 - 9:16 Eelco

Maar jouw vraag was dus over die relaties die carrier services en die capabilities van die ground handling agents, en het antwoord is dus Ja. Ook dat tarmac bypass verhaal is een voorbeeld, en ook dit voorbeeld van Emirates.

• 9:19 - 9:42 Tess

Jullie hebben dus van meerdere stations al bepaalde capabilities in Validaide staan.

• 9:45 - 10:29 Eelco

Ja. Ja, maar dat is dus los gekoppeld van die carrier services. Want wat wij vragen, en onze datamodelen lopen daar een beetje op spaak. We stellen dezelfde vragen aan de groundhandling agents zelf, en aan de Airline die die groundhandling agents gebruikt. Maar we hebben een vraag, welke standaard tarmac protection bied je aan?, en welke optionele tarmac protection bied je aan. Wat is er überhaupt?

• 10:29 - 10:47 Tess

[off topic, verzoek voor meer specifieke details]

- 10:51 - 11:36 Eelco

Ik had begrepen dat Qatar - Amsterdam, er is dus een coolroom, soms zijn er meerdere coolrooms, van die storage areas van 2-8 (graden), en wat ik begreep van Qatar een hogere prioriteit hebben op een aantal van de capaciteit. Want je kan natuurlijk hebben dat die op een gegeven moment vol is. En Qatar heeft dan een soort van gegarandeerde capaciteit. Als er dan bijvoorbeeld veel zendingen zijn van bv, Turkish en Qatar, dan heeft Qatar voorrang heeft.

En wij kunnen dan vragen aan swissport, hebben jullie een cold room, 'ja, wij hebben een coldroom', en dan vragen we aan Turkish hetzelfde 'ja die is er', en dan is er toch nog een verschil met prioriteit op capaciteit.

- 11:46 - 11:55 Eelco

En een van de problemen is dus wel, Dat is eigenlijk de partijen die dus wel extra investeren in dat soort dingen, die wil je ook de erkenning geven daarvoor.

En juist omdat dit soort details zo onduidelijk zijn, kun je

moeilijk concurreren op kwaliteit, want die kwaliteit is heel ontransparent.

[referentie naar formules voor inzichtelijke kwaliteit voor Validaide - not relevant]

- 12:29 - 13:15 Tess

Dat waren mijn vragen wel voor de groundhandling agents. Nu wil ik het hebben over airfreight forwarders. Want in essentie, hun main taak in terms of Pharma, is voor een optimale solution aanbieden, en zorgen/hopen dat ze het boeken. Maar wat zijn nog meer hun taken in bijvoorbeeld in Pharma? Want stel, ze hebben dan voor het komende half jaar deze zoveel shipments. Hier heb je een aanbieding, oh we krijgen het en vervolgens voeren we het uit. Je hebt ook adhoc aanbiedingen, of dat ze dat gewoon vraag krijgen van kunnen jullie dit doen, 'ja dat kunnen we', maar zijn er nog meer taken die een airfreight forwarder doen?

- 13:17 - 13:33 Eelco

Nou ja, de eerste taak van een forwarder in het algemeen, dan kunnen daarna doorvertalen naar Pharma. Een Forwarder, zijn partijen die de verladers/shippers, ontzorgen door het gehele transport te coördineren.

- 13:34 - 14:33 Eelco

Dus in het algemeen doen ze zelf niet veel. Dat heet een beetje in het jargon 'asset light'. In principe als forward hoeft je geen eigen vrachtwagens en warehouses te hebben en vliegtuigen en boten. Het kan wel, maar goed. In principe hoeft er niet en in principe van oudsher, zijn er mensen met een telefoon en fax. De verladers zeggen van Brussel naar Shanghai, en zij zeggen, oke wij regelen een trucking bedrijf om het van jou op te halen en naar het vliegtuig te brengen en een airline vandaar te brengen. Vaak regelen ze ook de douane inklaring, off cell in custom broker, en vervolgens regelen ze ook de opslag tussendoor, transport naar bestemming vanaf de andere kant van de vlucht. zij coördineren dat zodat alles op elkaar is afgestemd. En dat is in principe hun rol.

- 14:39 - 14:43 Eelco

In pharma is dat niet anders, Alleen het is wel een vrij gereguleerde wereld, Pharma. Waardoor er wat aanvullende eisen zijn. Omdat je niet zomaar willekeurig een vliegtuig gaan kiezen om mee te gaan vliegen. Dus voor die forwarders in de planning fase zijn er veel meer activiteiten en dat is ook waar wij op in spelen omdat de overheid eigenlijk stelt dat de farmaceutische fabrikant moet weten wat er met zijn producten gebeurt op ieder moment en zo wordt getransporteert en moet inschatten wat het risico daarvan is en dat risico dus ook moet managen./ interne of accepteren. Dus je moet Lane risk assessments maken, je moet je suppliers kwalificeren dus je moet zelf maken. Je moet je suppliers

kwalificeren en vaak worden er ook procedures afgesproken, Lane SOPS, om precies vastleggen hoe het wordt getransporteerd.

- 15:50 - 16:14 Eelco

Dus is veel meer overhead omheen in de farmaceutische wereld, dus dat is een groot verschil met Andree markten. Over het algemeen mag je niet zomaar iets transporteren. Het andere afspect is dat het temperatuur gevoelige producten zijn, en dat er dus een verpakking element aan zit. En dat is ook een ingewikkeld punt.

- 16:16 - 16:23 Eelco

Omdat in de meeste gevallen de shipper wel verantwoordelijk is voor de verpakking.

- 16:24 - 16:43 Eelco

Maar niet altijd. En ook het bepalen van welke verpakking het meest geschikt is, is ook soort samenspel tussen de forward en de shipper en vaak ook de airline. want het moet wel toegestaan zijn om een bepaalde verpakking te gebruiken in het vliegtuig.

- 16:47 - 17:27 Eelco

In sommige gevallen, moeten er bepaalde capability zijn, indicated voor een bepaalde verpakking. Voornamelijk met Active containers. Bij actief koelen moeten er bepaalde activiteiten worden uitgevoerd zoals het in een stopcontact doen, van zon container. In andere gevallen moet er dry ice worden vervangen, dus de groundhandling agents moeten ook de faciliteiten en de kennis hebben om met die verpakking om te gaan.

- 17:29 - 17:30 Eelco

Daarnaast, zit je met dat Active containers herbruikbare verpakking zijn, dus dat een heel stuk over reverse Logistics, dus die container moet ergens zijn aan begin en het einde wordt weer hergebruikt. Dat betekent niet dat je die container koopt, maar dat least/huurt alleen voor die zending.

- 17:59 - 18:14 Eelco

Thermo blankets eenmalig gekocht, meervoudig gebruikt. Active containers ip reusable, passive containers niet.

- 18:15 - 18:17 Eelco

Die Active containers, die moet je dus van iemand leasen. Je kan het als shipper direct bij de verpakkingsleverancier leasen. Maar de aircarriers hebben ook een contract met die verpakkingsbedrijven, en dan kan je een Active container leasen van de airline. En dan zorgt de airline ook van de gehele reverse logistics en dat alles. En dat heet carrier leasing. Veel air carriers bieden ook producten aan, om een bepaalde actieve container te leasen.

- 18:52 - 19:00 Tess

Maar als je dus een lijn zou trekken, air carrier kan de verpakking regelen maar je kunt het ook zelf doen.

- 19:11 - 19:12 Eelco

Het gebeurt dus zeker dat shippers zelf de verpakking regelen, gebeurd van deur tot deur.

- 19:21 - 19:33 Tess

En thermo blankets? Dat zit er vaak wel in of niet? Op verpakking gebied kan dus alles ook door de verlader/shipper zelf worden gedaan?

Eelco Ja

- 19:35 - 19:41 Eelco

Die dozen waar we net naar zaten te kijken, die passive (insulatie) dozen, dat gebeurt bijna altijd door de verlader/shipper zelf. Nooit door de air carrier gedaan.

- 20:12 - 20:26 Eelco

Soms doen de forwarders ook verpakking, dan wordt het op een bepaalde manier aangeleverd, en dan heeft de forwarder een rol in de verpakking. De forwarder heeft ook een rol in het adviseren over de verpakking dus en soms hebben ze ook een rol in verpakkingsproces.

- 20:28 - 21:00 Eelco

Ik sprak laatst met Agility, (ook een klant van validaide), een aantal Lanes hadden ze gekregen, ging met Active containers. Die lease is heel duur, dat is een paar €1000 per container van paar dagen, dus met Active containers willen ze het zo kort mogelijk, dus moet eerst zorgen dat het dus alleen maar Airport to Airport en dan moesten ze een vrachtwagen hebben dat gekoeld bleef. Maar dat ook het verpakking goed ging, en moet allemaal getest worden, en dat deed de forwarder allemaal.

- 21:30 - 21:57 Eelco

[referentie naar presentie, over testen van forwarders over nep zendingen, test shipments]
Kwalificatie van een Lane hangt af het gevoeligheid van het product en de waarde van het product, de forwarder managen die testen.

- 22:01 - 22:07 Tess

Nog een keer, Lane SOPs?

- 22:15 - 22:19 Eelco

Dat is een Standard operation procedure, specifieke afspraak met werk instructies voor alle partijen. Zeker als er herverpakkingen zijn, dan moeten er hele specifieke afspraken over zijn.

- 22:26 - 23:18 Eelco

Ook daar zie je grote verschillen tussen met farmaceutische fabrikanten hoe ze daar mee omgaan. Want het is heel vaak heel veel papierwerk, dus voegt enorm veel bureaucratie toe. Je kunt je afvragen 'lees iemand ooit die documenten?'. Maar zeker als er hele specifieke werkinstructies zijn, iets over te verpakken of er moet dry ice worden toegevoegd, of dat soort dingen. Dat staat dan daar in. Het is alleen vaak een afspraak tussen een forwarder en een

shipper terwijl de uitvoeren gedaan wordt door een groundhandling agent. Je moet er maar van uitgaan dat het door de hele keten wordt door gevoerd.

- 23:19 - 23:23 Tess

Je noemde dry ice en overpakking, wat staat er nog meer in die SOPs die er dan echt toe doen? En ook groundhandling agents.

- 23:25 - 24:00 Eelco

In SOPs heb je de beschrijving van het proces, bijvoorbeeld hoe de verlader boekt bij de forwarder, hoe de forwarder het doorbreekt bij de carrier, wat van bevestiging er over zijn. bijvoorbeeld hoe je het moet labelen, hoe die het moet aanleveren, op pallets bv. Wat voor pre alerts er zijn, dat het een week van te voren word aangekondigd, hoe het wordt gefactureerd. Allemaal afspraken

- 24:10 - 24:49 Natalie

Daar staat bijvoorbeeld ook in hoe lang iets maximaal op de tarmac mag staan?

Eelco

Typical staat er wel in ja. Time planning en verantwoordelijken en hand-overs. Hoe het er normaal uit

ziet. soms ook in het geval van afwijkingen, wat er dan moet gebeuren tijdens het proces, als bijvoorbeeld de vlucht is vertraagt.

[verzoek tot SOP vanuit Tess]

- 25:36 - 26:02

Deviation management kan achteraf maar ook tijdens.

- 26:06 - 27:00 Tess

Validaide werken in Lanes, forwarders in shipments.

Eelco

Uiteindelijk worden er goederen getransporteerd, dat zijn shipments, dat is waar het om gaat. Maar in de Pharma wereld, voordat je iets kan transporten moet je dus van alles in kaart brengen. Je moet weten hoe het wordt getransporteerd, je moet dat goedgekeurd hebben, je moet suppliers hebben gekwalificeerd, je moet risk assessments hebben gemaakt, SOPs gemaakt, verpakking gekeuden, dat gebeurt allemaal op Lane niveau. Validaide zit in de planningfase, niet zo zeer in de uitvoerende fase. Wij proberen de planning te verbeteren, de keuzes die je maakt optimaliseren voor de routing, hoe wordt het precies getransporteerd en verpakt. De tijd en energie die mensen daar nu in moeten steken, 100x minder te maken, omdat de informatie dan transparant is.

- 27:31 - 28:01 Tess

Is er mogelijkheid dat jullie op den duur, ook op shipment/ uitvoerende gaan focussen? Jullie doen nu Lane risk assessment, maar iemand wil weten specifiek voor lithium batterijen wat dan het risico is. Of jullie geven alleen de informatie als je iets wil verscheperen van A naar B.

- 28:16 - 28:35 Eelco

Wij zitten in de plannings fase, maar dan heb je de uitvoerende fase, de uitvoering het monitoring het boeken van een individuele zending. Daar heb je ook software voor, en communicatie omheen. Dat gaan we echt niet doen. Maar daarna heb je nog een stap, dat je die data van die shipment gaat analyseren. Op analytisch Nivea, op performance analyse. En dat kan wel een feedback loop geven naar je planning fase. En dan kan interessant zijn, vooral op het gebied van risico. Om de ervaring te gebruiken van de zending.

[Validaide van RISK nu QUALITY indicatie]

- 30:06 - 30:11 Tess

Jullie zouden een API kunnen zijn voor iemand die dit wil implementeren in hun boekingsplatform.

Eelco

Dat sowieso. Ook op het gebied van modelering van carrier services, hebben we het over gehad met Cargo.one, een boekingsplatform voor airfreight.

[samenvattend]

Forwarders zijn super veel tijd kwijt in de planning fase.

- 30:56 - 31:17 Tess

Sommige niet sommige wel, het echt het monitoren door het hele proces heen door de forwarders?

Eelco

Uiteindelijk doet een shipper en boeking, en die forwarder boekt het door, en dan zijn ze ook het monitoren, dus veel operationele mensen bij die forwarders .

Tess heeft nog meer vragen over validaide, ze verplaatsen naar een andere kamer.

In dit interview tekende Tess een schema op het bord die de aspecten van de products en services samenvatten zover zij dat kon. Ze vroeg of Eelco en Natalie wilden hebben bij het corrigeren en het vormen van een correcte basis van deze product en services van de aircarriers. Ze begon met de volgende aspecten op het bord

- speed
- packaging -> temperature - security
- Hygiene
- Professional Attendants - Boarding
- Capacity

• 2:40 - 3:09 Eelco

Temperatuur is niet alleen temperaturen range boeken, moet zoveel mogelijk proberen om in die range wordt getransporteerd.

gekoppeld aan packaging. Je kan een 2-8, maar dat los van verpakking. Airline

Tess

Packaging kan een onderdeel zijn om dat te bereiken.

Eelco

Maar het is ook een service, in bv het vliegtuig, warehouse etc. Maar het kan zijn dat je helemaal geen verpakking nodig hebt.

• 3:58 - 4:52 Eelco

Bij Ocean, reefer container, dan blijft altijd tussen 2 en 8 graden, dan heb je geen dure verpakking nodig.

Tess

Reefer, is ocean.

• 5:03 - 5:21 Natalie

Active container is verpakking, maar in een warehouse is het een service.

Eelco

Op de tarmac, heb je dus protection. En dat is grijze gebied van packaging en temperatuur. Op de dolly op tarmac, is tarmac protection.

• 5:33 - 5:50 Eelco

Is een truck packaging? Is de vraag. Is het dan een truck of is het dan packaging?

• 5:53 - 6:12 Eelco

Maar een thermo blanket is wel echt packaging

Tess

De services worden geboekt voor de preventie of damage & loss of goods.

- 6:48 - 7:03 Eelco

Als medicijnen niet meer werkzaam zijn, dat je het dan niet weet. Bv insuline, als het niet werkt, is het direct van invloed op het leven van mensen.

- 7:11 - 7:48 Eelco

Dat is de reden dat de hele wereld zo gereguleerd is, De overheid bemoeit zich daarmee om ons als mensen te beschermen.

Natalie

Ze hoeven niet alles te trekken, toch?

Eelco

Wordt bijna wel altijd gedaan, maar met een bepaalde risico analyse,
als jij kan aantonen dat het niet nodig is, dan hoef je geen
trackers doen maar er

- 7:49 - 8:18 Natalie En als het daarbuiten

worden miljoenen 'bockers' gebruikt.

is geweest (2-8 graad), dan gooien ze het weg? naar stability data. [natalie zegt, doe maar

Eelco

Ja dan gaan ze kijken
andere keertje]

Maar ze checken hoe ernstig het was, hoe stabiel het was.

- 8:25 - 8:59 Tess

Zou je boarding bij Speed zetten?

Eelco

Ja, Speed heeft vaak met prioriteit te maken, er zitten een aantal aspect aan, niet zo eenvoudig.

- 9:01 - 9:02 Eelco

Tijds elementen.

Proces elementen

Ik zit een beetje hardop te denken, maar meer concreet.

Een tijds element kan zijn: Hoeveel uur van tevoren kan je boeken?

Hoeveel uur van te voren kan je het aanleveren?

- 9:30 - 10:13 Eelco

Je bent ook als je er zelf moet zijn, dan moet je 2 uur van te voren zijn, toch? Er zit een minimum aan, voor het boarden. Dat soort tijden, minimum acceptance time.

Maar als jij dus een express service boekt, mag jij korter van te voren aankomen met je cargo, dat is the Cut off Time. Meer betalen om laten aan te komen.

- 10:14 - 10:42 Tess

En dat is in principe zodat het langer in een controlled environment is? Of juist meer tijd voor producten te maken, van uit de verladers

perspectief.

Eelco

In principe zodat je je vlucht niet mist, denk ik. Als je vrachtwagen in de file komt.

- 10:43 - 10:49 Natalie

En vanuit de farmaceutische gezien. Waarom willen ze liever? Een kwartier in plaats van 3 uur van tevoren?

Eelco

Ik weet het ook niet, je zit dit gewoon op de website van Lufthansa. Je hebt de optie voor die twee dingen. Waar om je dan kiest voor het een of het ander. Er zitten natuurlijk meerde aspecten aan, maar ja, je hebt nu minder kans dat je vlucht mist.

- 11:50 - 11:56 Eelco

Er is nog een ander aspect van tijd, the connectection times. Als je een stopover hebt, via Frankfurt naar Shanghai, dan heb je connection time. Daar zit ook een minimum aan. Als die vluchten een kwartier na elkaar vertrekken, haal je het niet he. en als je dus zo'n hoge prioriteit service boekt, of een Express service, dan bieden ze het vaker aan met een kortere minimum connection Time.

- 12:25 - 12:45 Eelco

Wat zegt 'groundhandlers' weet je wat? Dan brengen we het heel snel van het ene vliegtuig naar het andere, met een minimum connection time van 1 uur reden we dan nog wel, maar moetje wel extravoor betalen. Normaal gesproken brengen ze het naar het warehouse, en dan is de minimum connection 4. Met express bypass je dat.

- 13:10 - 14:01 Eelco

Voor ons, een flight search Engine, die minimum connection time een van de reden dat heel die flight search heel ingewikkeld is. Want dat scheelt per product, per hub. We hebben nu een functionaliteit dat je een vlucht kan toevoegen, moet je een aanname maken over de minimum connection time. Standaard is nu 3 uur. Soms is het juist langer of korter, afhankelijk van de search en airline.

- 14:04 - 14:05 Eelco

Er is ook priority in loading, weet ik niet alle details van. Ten opzichte van de verschillende cargo producten. Bepaalde producten hebben een hogere prioriteit. Dat het bijvoorbeeld niet mee kan, omdat het minder belangrijk is. Of je er voor betaald hebt of niet. En dat is gelinked aan die speeds.

- 15:28 - 16:27

[Not relevant to research, about complaints if your goods get kicked off, forwarders moeten het wss oplossen, in contract staat er een risico is]

- 16:58 - 17:12

Dus als ik het goed begrijp, heeft priority/loading heeft met capacity te maken.

Eelco

Douane heeft niet met loading te maken. Staat los van product en services

- 18:26 - 18:40 Tess

Op het onderwerp Dangerous goods? Je had een keertje gezegd dat de max aantal batterijen in een bepaalde vlucht.

- 18:54 - 19:46 Eelco

Dat ligt een stuk ingewikkelder, Dangerous good is een wereld op zich. Daar is een classificatie van, ontvlambare dingen ontplofbare dingen, radioactieve dingen, weet ik het wat allemaal, allemaal geklassificeerd. en dan heb je specifiek rondom batterijen in categorie, Maar daar heb je al subcategorieën in, bv lithium batterijen en dan hangt het er ook vanaf, hoe die dingen zijn verpakt. Je kan een pallet met laptops hebben, en dan zit die batterij in de laptop. Allerlei situaties, en er zijn aller situaties, en voor al die situaties zijn er specifieke restricties over batterijen.

- 19:50 - 19:53 Natalie

Doe jij niet alleen Pharma dan?

Tess

LARA is in principe voor Special Cargo. Pharma heeft wel prioriteit maar dangerous good en perishables zijn wel aspecten die ik mee moet nemen in mijn minimum ontology.

Eelco

Boven doen kan dangerous good ook Pharma zijn. Met dangerous good gaat het vaak om restrictie, is iets gewoon niet toegestaan. Het is nog meer gereguleerd, Pharma is een beetje een grijs gebied qua Airlines.

- 20:54 - 21:52 Eelco

In de luchtvaart als je iets met safety te maken hebt, dan is het echt heel streng reguleert. Iets kan gewoon niet, je moet de restricties weten, met betrekking op vliegveilingheid.

Tess

Voor dangerous is het je kunt het wel of niet verscheperen, er is geen optimum?

Eelco

Je hebt dus die special handling codes, voor alle categorieën. En wil je iets boeken, dan moet je specifiek zeggen ik wil dit, en dan is het de vraag of dat kan. Bij dangerous goods is het zwart of wit.

Tess

Hygiene, heeft dat een grote rol?

Eelco

Ik weet niet precies wat je daar mee bedoelt. Bedoel je dan schoonmaak? Ik weet niet of het echt hygiene is. Je wilt niet dat Pharma bij vis staat, wat wel gebeurt trouwens. Maar dat heeft voornamelijk te maken met wat er op de grond gebeurd, niet in het vliegtuig. Maar denk niet dat je daar veel kwaliteit attributen aan kunt koppelen.

Wel bij live animals heb je er mee te maken, stal schoon en weet ik het wat. Maar het is geen groot gebied, niet zo complex,

- 24:27 - 24:58 Eelco

Worden producten gesegregeerd? Dat soort dingen, maar het is geen groot ding van de features van de services.

[over professional attendees] Ik zou het meer zien als een onderdeel van een ander gebied, in live animals, dat je er mensen zijn, maar dan zou ik het zien als onderdeel van security en als het onderdeel van live Animals.

- 25:52 - 26:00 Eelco

Bij security kom je vaak twee dingen tegen dat misschien moeten we even apart op ingaan. En dat is ook nog wel gelinkt aan Pharma, over die opiods bijvoorbeeld. Medicijnen die dan worden geboekt met een extra security service. En daardoor conflicteert dat met de Pharma service. In handling zet je het of in een Cage of in een Coldroom. Want nou als je het allebei hebt. Dus dan heb je een conflict

Tess

Maar stel, ik boek dat wel allebei?

Eelco

Dan komt het waarschijnlijk in een Cage te staan, niet in een cold room.

Tess

In het geval van die opiods

Eelco

Het is heel relevant voor onze sector, er zijn altijd partijen die zijn zwaar aangeklaagd daarop. Heel verslavend. [over overleden drugs slaafden] Er is een hele markt voor, want mensen zijn verslaafd, dus is er een illegaal markt.

Tess

Dus stelen

Eelco

Houston and mundi Pharma, die boeken dan met beide aspecten,

Natalie

Er zijn wel cold cages toch?

Eelco

Goedzo natalie, die zijn er ook nog?

Tess

Stel je wilt het wel beschermt hebben, moet je er dan een manneke bij zetten?

Eelco

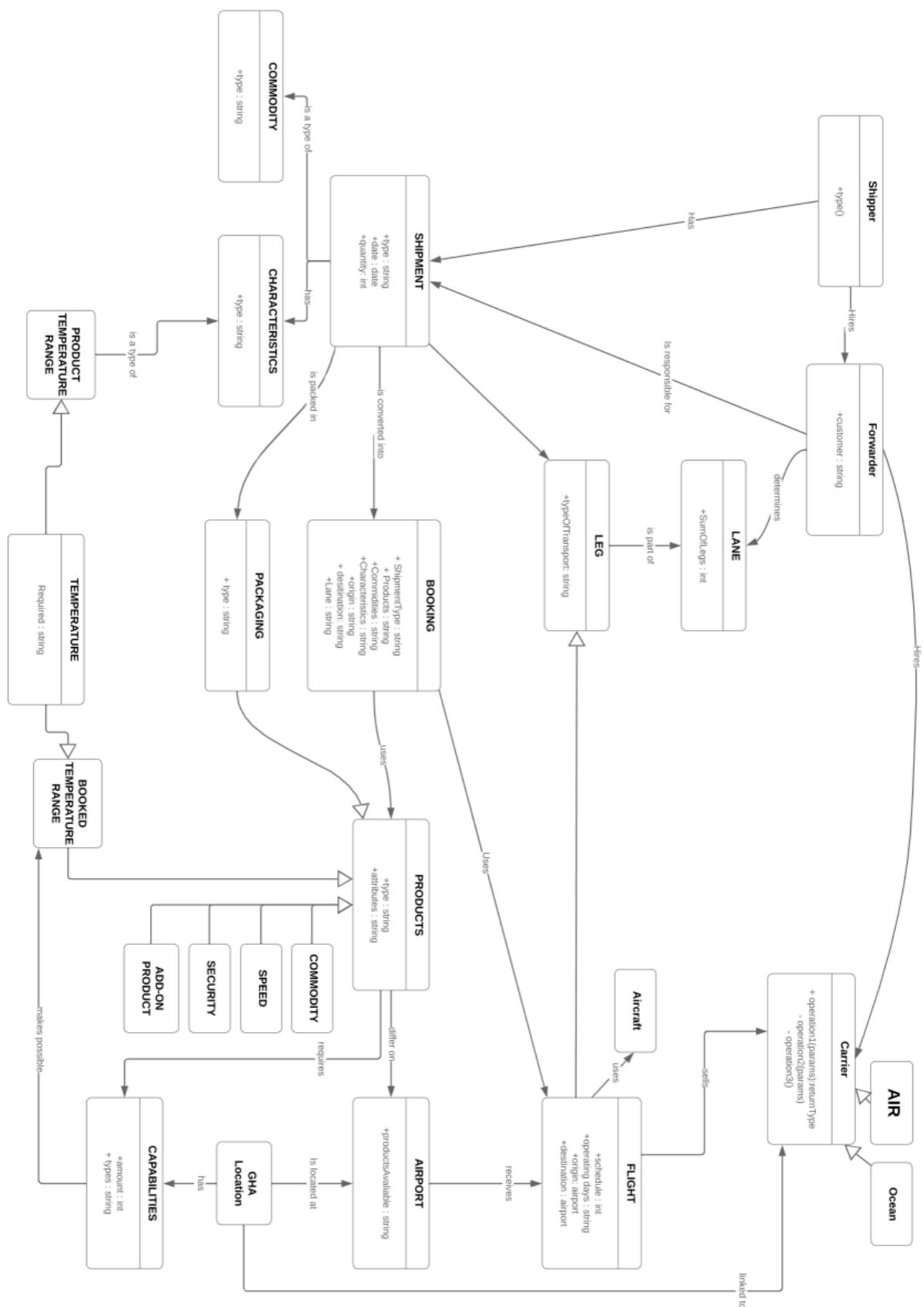
Dat weet ik ook niet precies, dat zijn de grenzen van de speciale situaties.

Je hebt ook verschillende levels, val en vul, valueable en vulnerable.

Er is al een voorziening in de IATA wereld voor die twee levels of security.
[voorbeeld met laptops en rolexen]

Het verschil van die services is wat er op de grond gebeurd.

Appendix E: UML Diagram



Appendix F: OPAL Lexicon

Concept	Subclass	Sub-Sub	Sub-Sub-Sub	OPAL	Justification	Notes
Airport				Object	This class is an entity within this ontology as airports are a prominent one of the main actors operates on this field	X
GHA Location				Object		Is part of Airport
Ramp				Object	This and its part-of classes are often referred to in products or services	Is part of GHA location
Tarmac				Object	This is where often temperature excursion occur, thus can be affected by ramp	Is part of Ramp
Warehouse				Object	This can be where the goods are stored, it is vital goods are stored	Is part of GHA location
Booking				Object	This is where the shipment and the products are combined.	despite it is not part of routing or product option, it is the
Capabilities				CA	The capabilities of airlines/GHA are one of the most important aspects of this ontology, as this is where knowledge is structured	
	Dangerous_Materials_Capabilities			CA	The capabilities to handle dangerous goods on an airport or tarmac	Speed can be referred to as many terms, the most reoccurring
		Dangerous_Good_Storage		Object	an environment specifically designed to store dangerous goods.	
Ground Handling Capability'				CA	GHA are a vital part to the process of shipping a product, and how they handle goods is often showcased as added value	
		Boarding		Process	the onloading of cargo onto the airplane	
			Preferred_Space_Access	CA	When there is a capability possible of a guaranteed access of the vehicle	
		Container_Handling		Process	the capability to handle containers on an airport, tarmac or warehouse	
		Cooled_Transport		Object	Temperature controlled transport	
			Cooled_Dolly	Object	the transport on a tarmac by a temperature controlled dolly	
			Cooled_Truck	Object	the transport from one airport to another by a temperature controlled truck	
			Normal_Transport	Object	non temperature controlled transport	
		Monitoring		Process	observing and checking the progress or quality of cargo over a period of time	
			Temperature_Monitoring	Process	observing and checking the temperature of cargo over a period of time	
	Packaging Handling'			Process	the capability to handle certain packaging at an airport, tarmac or warehouse	
		ULD buildup		Process	the buildup of an ULD/pallet that is to be transported in an airport	
Live_Animals_Capabilities				CA	The capabilities to handle live animals on an airport or tarmac or warehouse	
		Temperature_Controlled_Compartment		Object	This is part a temperature controlled capability that an airline can offer	
		*Preferred_Space_Access		CA	* reoccurring	
		Animal_Carrier		Object	small portable boxes, crates, or cages used to transport pets	
		Kennel		Object	a small shelter for a pet	
		* Monitoring		Process	* reoccurring	
		Trained_Personnel		Actor	Personnel that is qualified to handle certain cargo	
Oversized_Good_Capabilities				CA	The capabilities to handle oversized goods on an airport or tarmac or warehouse	
Security_Capabilities				CA	The capabilities to handle goods of high value or are prone to be stolen on an airport or tarmac or warehouse	
		*Preferred_Space_Access		CA	* reoccurring	
		Camera_surveillance		Process	video cameras used for the purpose of observing an area	
		*Monitoring		Process	* reoccurring	
		Security Container		Object	A container that protects the goods from theft or damage	
		*Trained_Personnel		Actor	* reoccurring	
		Vault_Storage		Object	a secure storage for the prevention of theft	
Speed_Capabilities				CA	The capabilities to handle goods with speed on an airport or tarmac or warehouse	
		*Preferred_Space_Access		CA	* reoccurring	
		*Monitoring		Process	* reoccurring	
Temperature_Capabilities				CA	The capabilities to handle temperature sensitive goods on an airport or tarmac or warehouse	
		*Temperature_Controlled_Compartment		Object	* reoccurring	
		*Cooled_Transport		Process	* reoccurring	
		*Monitoring		Process	* reoccurring	
		Packaging		Object	materials used to wrap or protect goods.	
			Container - Active and Passive	Object	an object for holding or transporting something	
			Insulated_Packaging - Thermal	Object	A type of packaging that protects the goods from ambient temperatures by insulation materials	
			No_Packaging	Object	no packaging	
			Passive_Packaging	Object	Packaging that passively holds the temperature	
		Temperature_Storage		Object	Storage designed to hold temperature controlled goods	
			Ambient_Storage	Object	Storage that holds ambient temperatures, and is not temperature controlled	
			Controlled_Cool_Storage	Object	Storage that holds cool temperatures (2 to 8 degrees), and is temperature controlled	
			Controlled_Frozen_Storage	Object	Storage that holds frozen temperatures (-15 to -25 degrees), and is temperature controlled	
			Controlled_Room_Temperature	Object	Storage that holds room temperatures (15 to 25 degrees), and is temperature controlled	
		*Trained_Personnel		Actors	* reoccurring	
Dangerous Goods Class				Attribute	the class allocated to the dangerous goods to indicate the severity of the good	

Documentation			Object	material that provides official information or evidence or that serves as a record
Characteristics			CA	The characteristics of a shipment/good influences what kind of products
	Commodity		CA	This how a shipment is labelled,
	Dangerous Cargo		CA/Object	Dangerous Goods are items that may endanger the safety of an aircraft/vehicle or persons on board of the aircraft/vehicle
		Batteries	CA/Object	a type of dangerous goods
	General Cargo		CA/Object	Ordinary goods transported on a ship, aircraft, etc., rather than special goods like oil, food products, etc.
	Live Animals		CA/Object	The humane transportation of live animals such as pets or tropic animals
		Tropical	CA/Object	a type of live animal
		Pet	CA/Object	a type of live animal instances applied
	Perishables		CA/Object	Goods that are perishable, such as fruits, vegetables
	Pharma		CA/Object	Temperature Controlled Medicine
	Valuable Cargo		CA/Object	Goods valued at over \$1,000USD per kilo includes jewels, cash, medical equipment, bank documentation, high couture f
	Vulnerable Cargo		CA/Object	Goods vulnerable due to its high value and more likely to be stolen
	Urgent Cargo		CA/Object	goods which are extremely liable to be stolen and are Urgent Shipment
	Product Temperature Range		CA	Most special cargo require a certain temperature range in which it should be transported otherwise the product will be damaged
Country			AA	The country were a shipment originates from and where it is going This attribute is a seperate class due to the fact that it is
Cargo			Object	This concept is the overarching concept of special cargo, which is the domain
	General Cargo		Object	Similar to Concept in Commodity
	Special Cargo		Object	Head of other Commodities
GHA Location			Object	The area where the products are offloaded and handled by Ground Handling Agents
Operation Day			CA	When deciding on routing options, one must now when the flights are, in order to make a planning
	Monday till Sunday		AA	The different days of the week Each day is a different Class in the Ontology
Organization			Actor	These are the actor that participate in the special cargo planning process
	Air Carrier		Actor	Airlines offer the products on how products can be shipped with This concept has many different synonyms, e.g. airline, carrier
	Freight Forwarder		Actor	Freight forwarders search for products and make the booking
	Ground Handling Agent		Actor	GHA handle the goods at the airports
	Ocean Carrier		Actor	Ocean Carriers transport goods by water
	Shipper		Actor	This is any organization that wants (special handling) goods transported The shipper isn't the one who transport the product, but
Pharma Certificate			Object	This type of certificate offers (some) guarantee in the quality of the transport
	GDP		Object	Type of certification (European Standard)
	IATA CEIV		Object	Type of certification (Global Standard)
Risk			CA	The packaging and route can be augmented based on the risk, therefore essential to the planning process
	Damage		AA	type of risk
	Temperature Excursion		AA	type of risk
	Theft		AA	type of risk
Route			Object	The planning is done on a route, so this element are essential to planning a shipment
	Leg		Object	A route consists of multiple legs which can be different types of legs
	Flight		Object	type of leg
		Direct	Object	this type of flight influences the risk of temperature excursion
		Connecting	Object	this type of flight influences the risk of temperature excursion
	Road		Object	type of leg
Shipment			Object	This is the main object, as this needs to be transported
	Booking		Object	This is the shipment transferred to a booking, where all the aspect are arranged
SPH Codes			CA	As special cargo is cargo that requires special handling, special handling codes can offer great insight in what is needed
Solution			Object	The product or service of an aircarrier that is used to transport cargo
	Add On Products'		Object	Extra products and services offered by an Airline
		Insurance	Object	Insurance of the cargo
		Tracking	Object	(real live) tracking of the cargo
	Big transport product'		Object	The product or solution offered by an airline concerning oversized goods
	Dangerous Goods Service'		Object	The product or solution offered by an airline concerning dangerous goods
	Speed Products'		Object	The product or solution offered by an airline concerning goods that need to be shipped fast
	Temperature Controlled Service'		Object	The product or solution offered by an airline concerning goods that need to be temperature controlled
		Fresh Services'	Object	The product or solution offered by an airline concerning perishable or fresh goods
		Pharma Solution'	Object	The product or solution offered by an airline concerning pharma goods or medicine
	Valuable Goods Product'		Object	The product or solution offered by an airline concerning goods that need to be secure
		Art	Object	The product or solution offered by an airline concerning art
		High_Value	Object	The product or solution offered by an airline concerning high valued cargo
	Veterinary Products'		Object	The product or solution offered by an airline concerning live animals

Storage			Object	a container or environment where goods or products are stored
	Dangerous_Good_Storage		Object	an environment specifically designed to store dangerous goods.
	Kennel		Object	a small shelter for a pet
	Temperature_Storage		Object	Storage designed to hold temperature controlled goods
		Ambient_Storage	Object	Storage that holds ambient temperature, and is not temperature controlled
		Controlled_Cool_Storage	Object	Storage that holds cool temperatures (2 to 8 degrees), and is temperature controlled
		Controlled_Frozen_Storage	Object	Storage that holds frozen temperatures (-15 to -25 degrees), and is temperature controlled
		Controlled_Room_Temperature	Object	Storage that holds room temperatures (15 to 25 degrees), and is temperature controlled
	Vault_Storage		Object	a secure storage for the prevention of theft
Tarmac			Object	A defined area on an airport intended to accommodate aircraft for purposes of loading or unloading cargo, refueling, part
Temperature			CA	As specific cargo is often temperature sensitive cargo, this is an important attribute
	Ambient Temperature		CA	The outside temperature can influence the risk
	Booked Temperature Range		CA	It is of importance that there is a certain temperature booked
	Product Temperature Range		CA	This is the range in which the goods should be transported
Transport			Object	Through which industry the cargo is shipped
	Airfreight		Object	The carriage or transportation of goods or cargo by air
	Land Freight		Object	The carriage or transportation of goods or cargo by land
		Railways	Object	The carriage or transportation of goods or cargo over land by trains
		Roadways	Object	The carriage or transportation of goods or cargo over land by road vehicles such as trucks
	Ocean Freight		Object	The carriage or transportation of goods or cargo through sea or oceans
Vehicles			Object	This is related to the type of transport, and also influences risk
	Aircraft		Object	A type of vehicle, to differ from other vehicles
		Compartement	Object	A part of the airport
			Object	This is part of a temperature controlled capability that an airline can offer
	Ship		Object	A type of vehicle, to differ from other vehicles
	Truck		Object	A type of vehicle, to differ from other vehicles
	Train		Object	A type of vehicle, to differ from other vehicles
Warehouse			Object	A building made for storing goods, located at the airport

Appendix G: Object and Data properties

Domain	Range	Object Properties	Data Properties	OPAL
Airport/Organization	string		hasAddress	attribute
Container/Aircraft	integer		hasCapacity	attribute
	string		hasCode	attribute
Connecting Flight	integer		hasConnectionTime	attribute
	integer		hasDeliveryTime	Attribute
	integer		hasExposureTime	attribute
Airport	string		hasICAOCode	attribute
	integer		hasMinimumAcceptanceTime	attribute
Solution/Airport/Organization	Name		hasName	attribute
Product Temperature Range/ Booked Temperature Range	string		hasTemperatureRanges	attribute
	string		hasTransferTime	attribute
Shipment	string		hasWeight	attribute
Route	string		hasDurationTime	attribute
Shipment	string		hasValue	attribute
Solutions/Capabilities	Risk	decreases		association
SPH	shipment	designates		association
GHA	Ground Handling Capabilities	executes		association
GHA/Airlines	Pharma Certification	hasCertification		association
Shipment	Shipment Characteristics	hasCharacteristics		aggregation
Shipment	Commodity Type	hasCommodityType		aggregation
Flight - Leg	Airport - Country	hasDestination		aggregation
Flight	Operating Day	hasOperatingDay		association
Flight - Leg	Airport - Country	hasOrigin		aggregation

Booking	Route	hasRoute		aggregation
Booking	Solution	hasSolution		aggregation
Shipment	Product temperature range	hasTemperatureRange		aggregation
Transport/Packaging	booked temperature range	hasTemperatureRange		aggregation
Connecting flight	country	hasTransitIn		aggregation
Shipper	Freight forwarder	hires		association
Freight forwarder	Air or Ocean Carrier	hires		association
Capability	Airport	isAvailableAt		aggregation
Shipment	SPH	isDesignatedBy		association
GH Capability	GHA	isExecutedBy		association
Solution	Airline	isExecutedBy		association
Airline - GHA	Airport - GHA locatin	isLocatedAt		aggregation
Airport	Country	isLocatedin		aggregation
Shipment	Packaging	isPackedIn		aggregation
GHA - Tarmac	Aiport - GHA	isPartOf		aggregation
Shipment	Airline	isShippedBy		association
Freight forwarder	Booking	makes		association
Airline	Solution	offersSolution		aggregation
Aircraft - Truck	Flight - Road	operatesOn		aggregation
Type of Solution	Capability	requiresCapability		aggregation
Airline	Shipment	Ships		association
Flight - Road	Aircraft - Truck	usesVehicle		aggregation
Solution	Solution	canBeCombined With		association
Freight Forwarder	Documentation	arranges		association
Freight Forwarder	booking	books		association
Shipper	Booke temperature range	choosesBookedTemperatureRang	e	association
Airline/Freight Forwarder	Packaging	choosesPackaging		association
Dangerous Cargo'	Dangerous goods Class	hasClass		generalization
Products	Capability	includesCapability		aggregation

ambient temperature	Temperature risk	increases		association
Shipment	warehouse	isStoredAt		association
Booking	Transport	isTransportedBy		aggregation
Airline	Capability	offersCapabilities		association
aircraft	airport	operatesAt		aggregation

Appendix H: Competence Question Assessment

Question	Real-life answer	Ontology answer	Compliance and relation
Does a pharma solution have a booked temperature range?	Yes	Yes	YES: Temperature Controlled Solutions ‘has temperature range’ <i>some</i> Booked Temperature Range
Does lithium batteries transport have restrictions?	Yes	Not fully deductible	SEMI: Dangerous Goods Class ‘has maximum capacity’ (classes are not populated yet)
Is there a difference between pharma products and live animal products?	Yes	Yes, in terms of capabilities	YES: difference in ‘has capability’ Temperature Capabilities and Live Animal Capabilities
Does special cargo have special handling codes?	Yes	Yes	YES: SPH ‘designates’ <i>only</i> Shipment
Does general cargo have special handling codes?	No, not as special but as general	Not fully deductible	SEMI: General cargo is also shipment, thus is designated, but there are no instance of SPH (yet)
Does shipment characteristics, such as temperature, affect the product that is chosen?	Yes	It is implied	SEMI: e.g. Temperature Controlled Solution ‘is stored in’ <i>some</i> temperature storage.
Does the tarmac influence temperature risk?	Yes	Yes	YES: Tarmac ‘has temperature range’ <i>some</i> Ambient Temperature & Ambient Temperature ‘increases’ Temperature Excursion Risk
Does the air carrier product offer packaging?	Yes	Yes	YES: Airline Carrier ‘offers capabilities’ <i>some</i> Capabilities (Packaging is type-of Capabilities)

Does the shipper book the shipment?	Yes	Yes	YES: Freight Forwarder ‘books’ <i>some</i> Booking
Do capabilities play part in the products airlines offer?	Yes	Yes	YES: e.g. Temperature Controlled Solution ‘includes capability’ <i>some</i> Temperature Capabilities
Does exposure time influence temperature risk?	Yes	Not deductible	NO: exposure time is an attribute and not a concept that can influence other concepts
Does a 2 to 8 degrees shipment require packaging?	Depends on needs of shipper	Yes, if shipper chooses so	SEMI to YES: Shipper ‘chooses booked temperature’ <i>exactly 1</i> Booked Temperature Range. Packaging ‘has temperature range’ <i>exactly 1</i> Booked Temperature Range
Is an airport located in a country?	Yes	Yes	YES: Airport ‘is located in’ <i>exactly 1</i> Country
Do horses require special transport?	Yes	Not (fully) deductible	SEMI: Veterinary Services ‘includes capability’ <i>some</i> Live Animals Capabilities (includes transport options)
Does an airline do the ground handling of the shipments?	No	No	YES: Ground Handling Capability ‘is executed by’ <i>some</i> Ground Handler
Can a pharma product have multiple temperature aspects?	No	No	YES: Shipment ‘has temperature range’ <i>exactly 1</i> Product Temperature Range & Temperature Controlled Solution ‘has temperature range’ <i>exactly 1</i> Booked Temperature Range
Does a lane consist of only flights?	No	No	SEMI: Route has subdomain leg with road and flight options.

Do pharma solutions require certain handling capabilities at the airport?	Yes	Yes	YES: Temperature Controlled Solution ‘includes capability’ <i>some</i> Temperature capability (e.g. Cooled Transport or Temperature Storage)
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Appendix I: Annotation Evaluation

Annotation	Relevance	Presence
CERTIFICATION	yes	yes, as a class
shippers have to rely mainly on the forwarders	yes	yes, triple incorporated: shippers, forwarders and the relation
tracking information mainly from carriers	yes	yes, triple incorporated: tracking, air carrier and the relation
quality data are CEIV Pharma Acceptance Checklists	yes	partly, CEIV pharma certification is implemented, checklist not.
Quality Analysis (QA) checks.	no, this is execution, not planning of the shipment	no
access to these quality data after an excursion or a QA issue and during a CAPA investigation.	no, this is execution, not planning of the shipment	no
hard for them to assess the overall quality	no, this is execution, not planning of the shipment	no

the information on temperature can only be collected after arrival	partly, certain concepts are relevant, but collection is execution of a shipment, not planning	partly, temperature is incorporated
CEIV certified operators do monitor	yes	yes, pharma certification, monitoring are concepts that are incorporated
data are only shared in case of a CAPA investigation	no	no
the demands that the healthcare industry place on logistics are very high – and specific	yes	yes, pharma solutions require a lot of facets, and this is incorporated within the ontology
our products allow you to get your life-saving cargo to its destination.	yes	yes, triple incorporated: product, pharma and the relation
Cool Center	yes	yes, cool center is a synonym for temperature controlled environment, this concept is incorporated.
a temperature-controlled, optimized cold chain <ul style="list-style-type: none"> • thanks to shorter transport routes and fewer interruptions during transfer, and temperature-controlled compartments 	yes	partly, the temperature controlled cold chain is incorporated, however the attributes that it consists of are not all fully implemented (e.g. few interruptions)
cooling containers	yes	yes, concept is incorporated as active or passive container
continuous shipment monitoring	yes	partly, concept is incorporated, however the attribute ‘continuous’ isn’t incorporated

shipment tracking in real time	yes	partly, shipment tracking is incorporated but the real time attribute is not.
teams of experts	no	no
handled appropriately	yes	yes, shipment requires (appropriate) handling
transportation solutions for various commodities of Dangerous Goods	yes	yes, class of dangerous is incorporated, the instance of solutions will be applied in another research.
preventing any delay caused by improper packaging or document discrepancy.	yes	no, but documentation will now be incorporated as a concept
training and certification for IATA regulations	partly, training is not relevant for planning a shipment	yes, IATA/CEIV certification is incorporated
network of cooperating partners includes agents	yes	no, this network attribute is not incorporated
certification and packing, recertification for transshipments, pre-clearance and special delivery for shipments requiring necessary permissions or exemption.	yes	yes, these concepts are incorporated, except for preclearance.
Extensive experience and expertise	yes	yes, incorporated as trained personnel
Inspection of packaging conditions and documentation	yes	yes, packaging is incorporated
Maintain sensitive handling during retrieval,	yes	yes, handling of cargo is incorporated

ensure a timely acceptance and prevent any possible delays	yes	no, this attribute isn't incorporated
Best suited carrier and routing selection,	yes	yes, that's the purpose of the use of the ontology
consistent service	no	no
Coordination of shipments to remote destinations	yes	yes, this instances can be implemented in airport, and if there are capabilities available at that airport.
ACS arranges and coordinates all required steps,	no	no
high Quality and Reliability standards	yes	yes, certification as a concept
Secure and constant surveillance,	yes	yes, the concept is incorporated
Proper segregation of incompatible dangerous goods	no, despite that it is vital, this is the law and is consistent amongst solutions	no
Prompt and thorough communication	yes	partly, this is implemented through surveillance or monitoring, as an aspect of a solution
Hard-copy Proof of Delivery	no	no
state-of-the-art equipment in each warehouse	yes	partly, warehouse is incorporate, the attribute of 'state-of-the-art' equipment not.
efficient, seamless and safe handling of any type of cargo	yes	partly, handling and cargo is incorporated, but the 'efficient' attributes not.

hub network model	no	no
access connections within a 48-hour delivery time - including handling	yes	partly, handling is incorporated but the attribute of time limits is not.
20,000m ² of total warehouse space	yes	partly, warehouse is incorporated, and now the capacity of a warehouse will also be incorporated
Dedicated pharmaceuticals warehouse	yes	yes, temperature storage is incorporated.
zones for cargo with special requirements	yes	yes, temperature storage is incorporated.
24/7 surveillance 99.98% safety index TAPA certified	yes	partly, surveillance and certification is incorporated but not safety index.
Customs cleared cargo ready for pick-up within 4 hours	yes	no, this attribute isn't incorporated
Assistance with customs clearance	yes	no, this attribute is not incorporated
Trucking services	yes	yes, this concept is incorporated
24/7 customer service helpdesk	no, this does not concern with planning	no
be picked up within 12 hours from the arrival time into Anchorage.	no, too specific for the structural ontology that was constructed	no
labeled clearly if they are chilled or frozen.	no, this is execution not planning of a shipment	no

DO NOT mix meat or seafood with gear.	no, this is execution not planning of a shipment	no
every effort will be made to accommodate your frozen and chilled shipments	yes	yes, the concepts frozen and chilled shipment are incorporated
Frozen and Chilled space is limited due to high shipping volumes during peak	yes	partly, storage is incorporated, but not its' limitation during a certain time period
most of our agents do not have frozen and chilled facilities.	yes	partly, when instances are applied, these distinctions will be made
make arrangements in advance with NAC to ensure adequate space exists on the flight	yes	yes, capacity is incorporated
Animals must not be tendered for shipment more than four hours prior to scheduled departure time	yes	no, this attribute is not incorporated
provide a contact phone number so that NAC may notify them in the event of a flight cancellation or overflight	no, this is does not distinct one solution from another, these are precautions.	no
All live animal shipments must be prepaid.	no, this is does not distinct one solution from another, these are precautions.	no
All federal, state or local health regulations must be met	no, this is does not distinct one solution from another, these are precautions.	no
shipped in an approved airline type kennel or other suitable container	yes	yes, containers are incorporated

which meets the standards of an approved container		
Non-airline type kennels must be approved at the time of acceptance by a lead supervisor.	no	no
one adult animal per kennel or two puppies/kittens.	yes	no, this attribute is not incorporated
Animals not claimed within 4 hours of arrival at the destination will be boarded in a suitable kennel.	yes	no, this attribute is not incorporated
All charges for this service will be the responsibility of the consignee	yes	yes, triple incorporated: shipper and shipment and the relation
not claimed within 48 hours of arrival at the destination will be returned to the shipper at the shipper's expense	no, this is execution not planning of a shipment	no
The shipper must declare all hazardous materials,	no, this is law, not planning of a shipment	no
products to arrive in perfect condition and fully compliant to global and local regulations.	no, as one is not gonna promote 'our company delivers in suboptimal conditions. this is marketing and not an attribute	no
full oversight of your entire logistic chain,	yes	yes, incorporated as tracking, monitoring
efficient end-to-end solutions	yes	yes, this is incorporated as a solution

our advanced Lane Risk Assessment data	yes	partly, risk is incorporated, but not as sophisticated, as mentioned in the design workflow
we customize solutions	yes	no, as mentioned augmentation of solutions isn't incorporated
194 GxP certified operations all over the world.	yes	yes, certification is incorporated
highly trained experts can stand by 24/7/365 to monitor and support	yes	yes, trained personnel and monitoring are incorporated.
arrive at their destination with the required compliance level, proven by the right documentation.	yes	no, but documentation will now be incorporated as a factor that can influence risk
specialised and professional air cargo services for temperature sensitive shipments	yes	yes
Active container	yes	yes, concept is incorporated
Thermal Dolly	yes	yes, Cooled dolly is incorporated
tarmac at Hong Kong International Airport	yes	yes, tarmac is incorporated, the airport as well, the instance Hong Kong is not (yet)
Multiple Critical Control Points(CCP) at each shipping point	yes	yes, this is an instance for the concept monitoring
temperature tracking	yes	yes, tracking is incorporated
pre-alert system when an active container temperature reading	yes	no, this attribute of temperature monitoring isn't incorporated

reaches a specific threshold for preventive action		
Speedy ground logistics avoiding prolonged exposure	yes	partly, but more detailed attributes will now be incorporated for speed capabilities
cargo experts and modern freighter fleet	no, this are not vital concepts in the choice set of routing options or products	no
three compartments enabling different temperature settings from 4°C to 29°C•	yes	yes, compartments and air conditioning is incorporated
compliance with IATA TCR and CEIV Pharma	yes	yes, pharma certification
Exact temperature monitoring	yes	yes, monitoring as a concept is incorporated
Special packaging solutions and thermal blankets for palletized shipments	yes	yes, packaging, solutions, shipments, and thermal blankets are incorporated
online track & trace option for all shipments	yes	yes, tracking is incorporated
QEP Envirotainer accredited network of ABC stations	yes	yes, active containers are incorporated
Three independently selectable temperature zones• Selectable target temperature range from 4°C to 29°C for each cargo compartment•	yes	yes, temperature ranges, product and booked, are incorporated

widebody aircraft	yes	partly, aircraft are incorporated, but not the types
suitable positions for temperature-sensitive cargo transportation based on temperature mapping	yes	partly, temperature-sensitive cargo transportation is incorporated, but not based on the attribute temperature mapping
dedicated storage area for pharmaceutical products	yes	yes, temperature sensitive storage is incorporated
automated cargo handling system	yes	no, this attribute isn't incorporated
99,98% safety index, TAPA certified	yes	partly, certification is incorporated
IATA and IOSA certified,	yes	yes, certification is incorporated
IATA CEIV (pharma) and QEP certified stations	yes	yes, certification is incorporated
24/7/365 Control Tower (CT) operation	yes	yes, incorporated as surveillance
real-time, round-the-clock monitoring	yes	yes, monitoring is incorporated
fully trained supply chain specialists	yes	yes, trained personnel is incorporated
Over 30 airfreight destinations with effective connectivity options through hub in Moscow and 48 hour delivery time•	yes	yes, GHA locations is incorporated, and Hub will be incorporated as a result of this evaluation.
stable, precise temperature control	yes	yes, incorporated as monitoring

active and passive cold chain packaging solutions	yes	yes, active and passive packaging
temperature-control solutions	yes	yes, as a concept incorporated
trust CSafe as an indispensable cold chain partner	yes	yes, these are instances of organizations that are present in the domain
kept safe and stable with CSafe's best-in-class cold chain packaging solutions.	yes	yes, these instances of the concepts, packaging and organization, are incorporated
unmatched insulating efficiency of our proprietary ThermoCor® Vacuum-Insulated Panels (VIP).	yes	yes, this is an instance of the concept packaging
superior thermal efficiency	yes	yes, this concept as temperature controlled packaging or transport is incorporated.

new service centre facility in pharma hub San Juan, Puerto Rico.	yes	yes, these are instances of concept that are incorporated in the ontology: airport, capabilities
accommodate the growing demand for CSafe's specialized containers	yes	yes, instances of incorporated concept: containers
new facility will ensure our RKN and RAP containers operate at top system performance,	yes	yes, instance of incorporated concept: containers
time:matters is now offering its dangerous goods transport	yes	yes, transport of dangerous goods is incorporated as a concept

service across the globe		
facilitate the transportation of time-critical goods in hazard classes 2, 3, 4, 5, 6, 8 and 9.	yes	yes, these are instances of dangerous good class
personally supervised loading on the apron.	yes	yes, tarmac handling is incorporated
"In Frankfurt, Munich and Vienna, time:matters is even able to facilitate tail-to-tail loading for particularly time-critical, dangerous goods shipments."	yes	yes, instances of incorporated concepts: dangerous good commodity, loading and airports
opened in Guarulhos, Brazil, its \$3.5 million perishable hub, a controlled-temperature cooler facility	yes	yes, instances of incorporated concepts: airport, storage
area of 1,637 sq m, of which 50% are equipped with variable temperature cooling chambers that offer refrigeration ranges of 0 to 2 °C and 2 to 12 °C for storage and re-palletising.	yes	yes, instances of incorporated concepts: storage, temperature ranges
investing in leading-edge infrastructure to protect the freshness of the products carried,	yes	partly, perishable products are incorporated but this aspect is not.
global network covering over 155 destinations centered in Dubai	yes	yes, instances of incorporated concept: airport, GHA location
modern fleet of all wide-body aircraft	partly, fleet was rejected as term as it does not offer insight	partly, the concept aircraft is incorporated but the fleet is not.

	products or services, or routes	
Emirates Delivers, a new e-commerce platform	no, it is a competitor but not relevant to be implemented into the ontology	no
promote Dubai as an e-commerce fulfilment hub for customers based in the Middle East, Asia and Europe.	yes	partly, hub isn't incorporated but airports are. The rest are instances.
Emirates Fresh.	yes	yes, perishable solution
Close to 11,000 high-priority shipments were moved across six continents under the Emirates AOG product during 2019.	yes	yes, triple is incorporated, shipment, product and the relation
increase of 6 percent in the volume of high-value goods that were flown under Emirates Safe VAL and a 12 percent increase in demand for Emirates Pets.	yes	yes, triple is incorporated, shipment, product and the relation
transportation of relief materials for natural disasters, equipment for music concerts, flowers and other perishables.	yes	yes, instances of special cargo
new handling facility dedicated to pharmaceutical cargo at Chicago airport.	yes	yes, temperature controlled capabilities
temperature-controlled zones for acceptance and delivery, pharma cargo build-up and break down, storage and direct ramp access and is	yes	yes, these concepts are incorporated, temperature storage, handling of the product. perhaps just not as detailed. Certification is also incorporated

also certified under EU GDP guidelines.		
Emirates SkyCargo moved its pharma handling operations at Copenhagen airport to a dedicated GDP-certified facility.	yes	yes, triple is incorporated, airline, pharma certification and relation
monitored over 1.5 million shipments using Cargo iQ guidelines	yes	yes, certification is now due to this annotation incorporated
new version of its Crēdo ProEnvision web-based asset management tracking and tracing software.	yes	yes, tracking is incorporated as a concept
empowers customers to more easily scale and manage large volumes of shippers in multiple locations.	yes	yes, big shipments are incorporated within the special cargo ontology
(IoT) makes its way into pharmaceutical cold chain packaging industry,	yes	yes, packaging is incorporated, iot will be an instance
It traces the location and condition of Crēdo shippers as they travel from warehouse to processing centre to customer sites and back again.	yes	yes, tracking and monitoring is incorporated
provide immediate updates on pickup and delivery of shipping units throughout the world	yes	yes, monitoring and tracking is incorporated
provides automatic alerts and triggers for maintenance,	yes	yes, monitoring is incorporated.

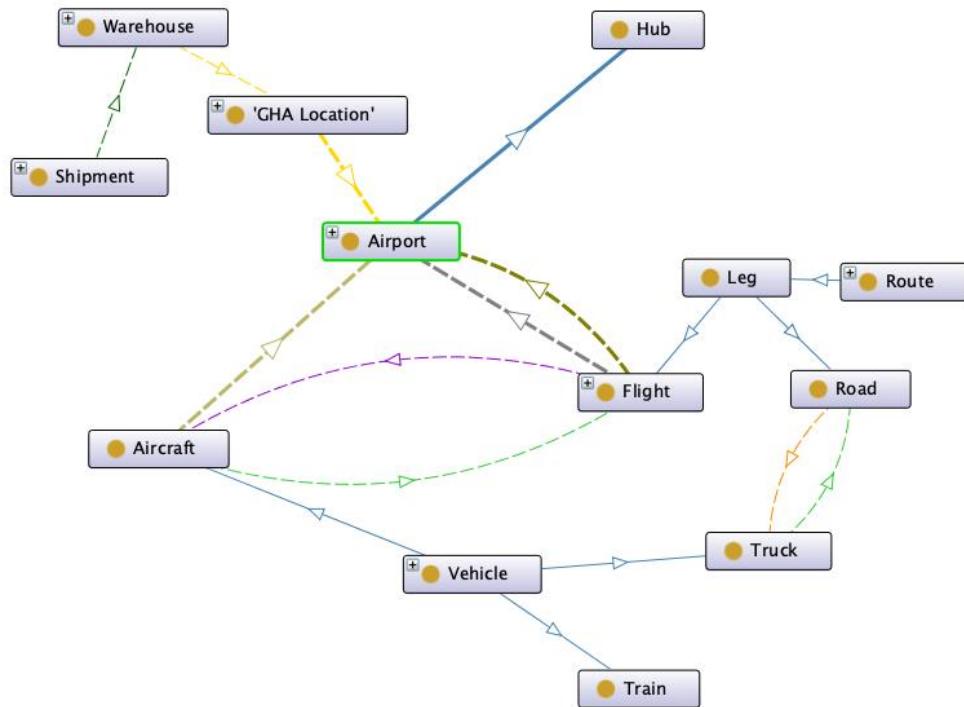
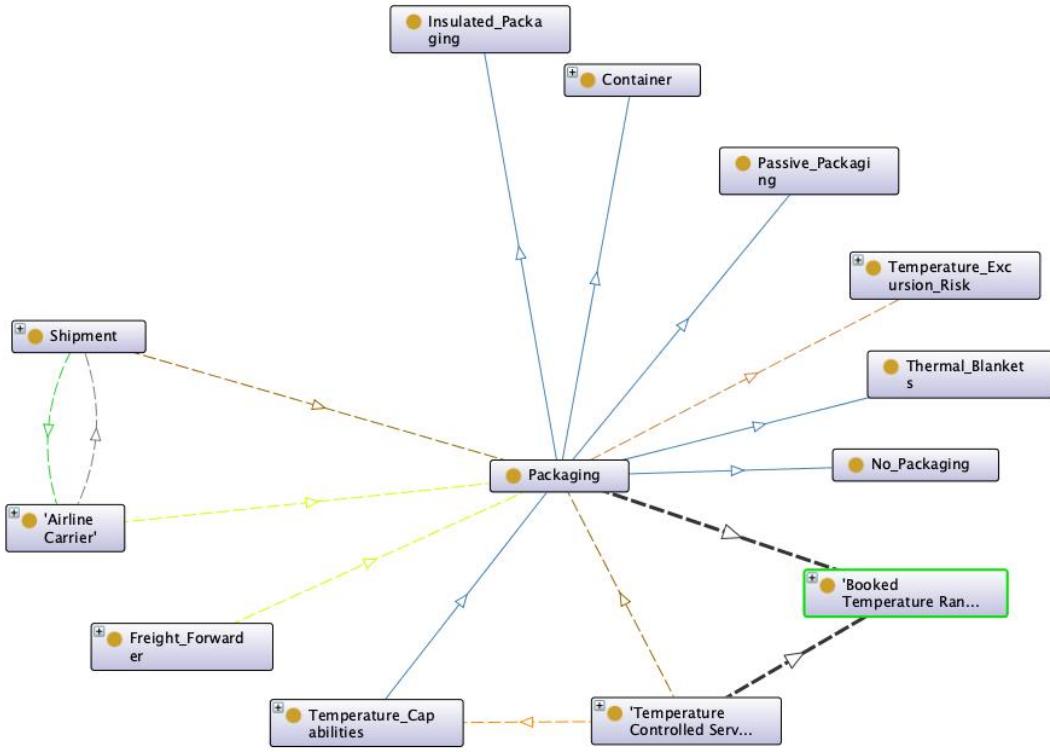
refurbishment, re-use and next shipments.		
more rich and varied data being collected, empowering pharmaceutical manufacturers and their logistics partners to better assess challenging shipping lanes and distribution modes	yes	yes, monitoring, pharma and organizations, as well as routes are incorporated, and the relations amongst them
real-time update pet travel carrier — CarePod,	yes	yes, incorporated as concept: animal carrier
(IATA) compliant pet travel carrier that can accommodate dogs and cats,	yes	yes, general certification is now incorporated in the ontology based on this evaluation
booked between three and thirteen days prior to departure.	yes	no, time restraints to booking are not yet incorporated
operational at eight US locations	yes	yes, indication of GHA location
premium pet travel solution,	yes	yes, solution in live animal transportation
CarePod has elaborate safety features,	yes	partly, attributes of animal carrier are not incorporated (yet)
built-in hydration system,	yes	no, this attribute is not incorporated yet
pet travel carriers are made with human grade materials	yes	no, this attribute is not incorporated yet
enterprise level GPS tracking and monitoring system that directly connects the pet's journey to the Center,	yes	yes, this is an instance of the concept monitoring

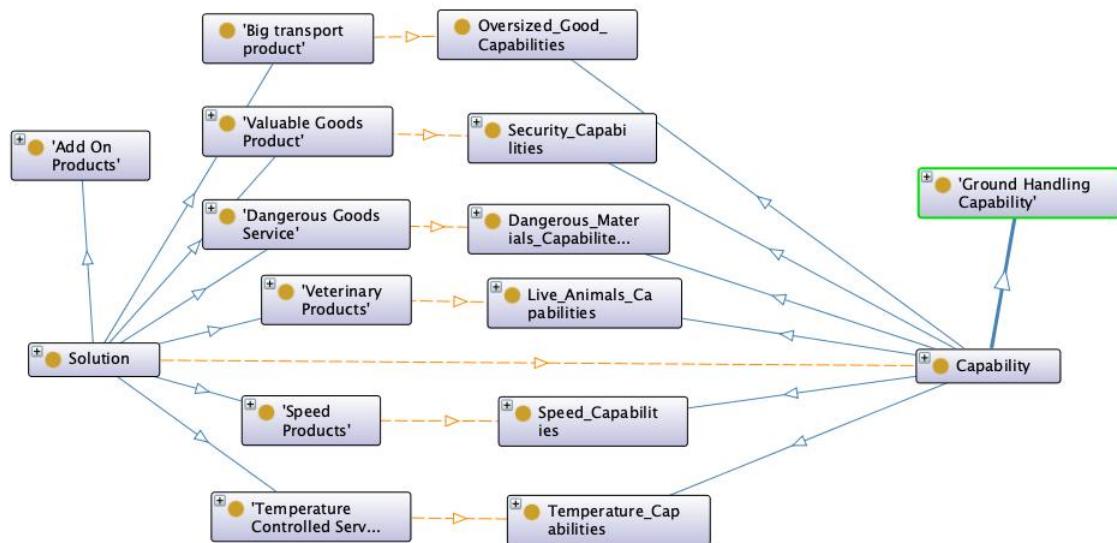
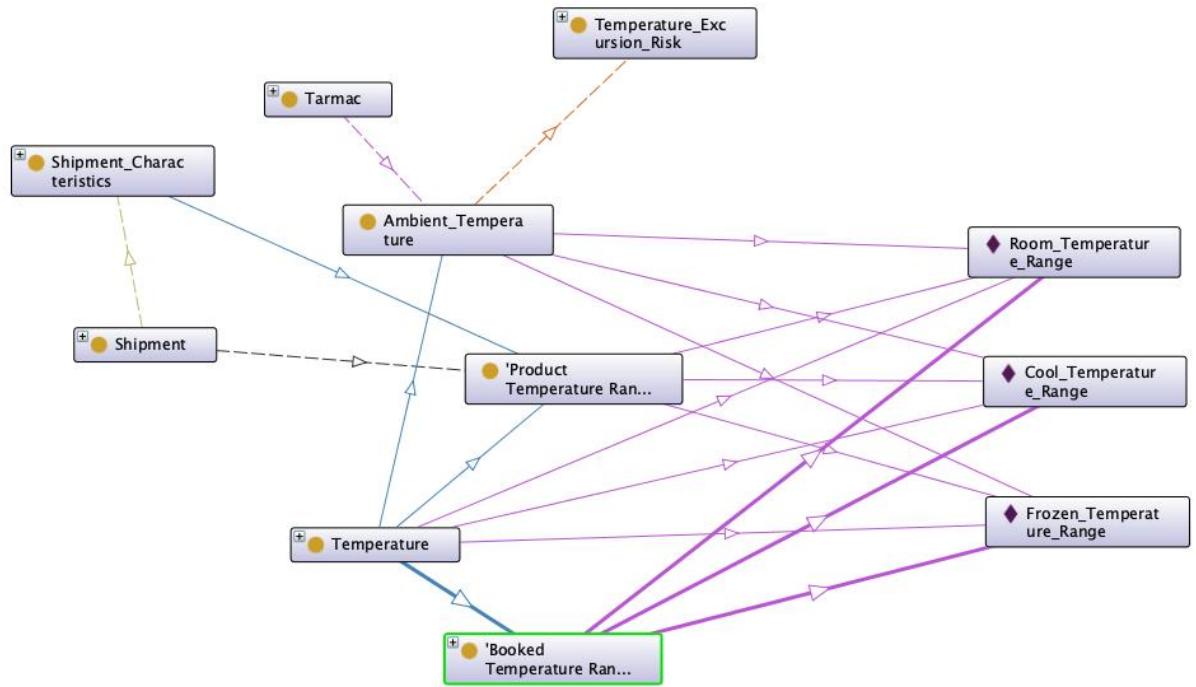
trained experts who then send out the right staff on the ground to check on the pet as in when needed	yes	yes, incorporated as a concept: trained personnel
view pet's key travel updates	yes	yes, incorporated as concept: monitoring
temperature-controlled holding areas and vehicles in numerous locations and overnight kenneling services.	yes	partly, kennel is incorporated, as well as animal carrier, but vehicles for this product is not
guarantee capacity during peak periods through block space agreements,	yes	partly, capacity is incorporated however, block space agreements is not.
100% shipment visibility from pickup to delivery.	yes	partly, attributes of monitoring is not incorporated
With speed-to-market becoming more and more critical, our new Direct Express – Australia service is well positioned to meet this need.	yes	yes, speed solutions/products are incorporated
temperature-controlled warehouse in Europe	yes	yes, warehouse and temperature storage is incorporated, and by this annotation the relationship has also been implemented
forwarder's pharma warehouses'	yes	yes, this is an instance of the incorporated concept warehouse
different temperature areas: from ambient (15°C to 25°C), and cool (2°C to 8°C) to frozen (-15°C to -25°C).	yes	yes, temperature ranges are incorporated
holding a Wholesale Dealer Authorisation (WDA),	yes	yes, (general) certification is now incorporated into the ontology

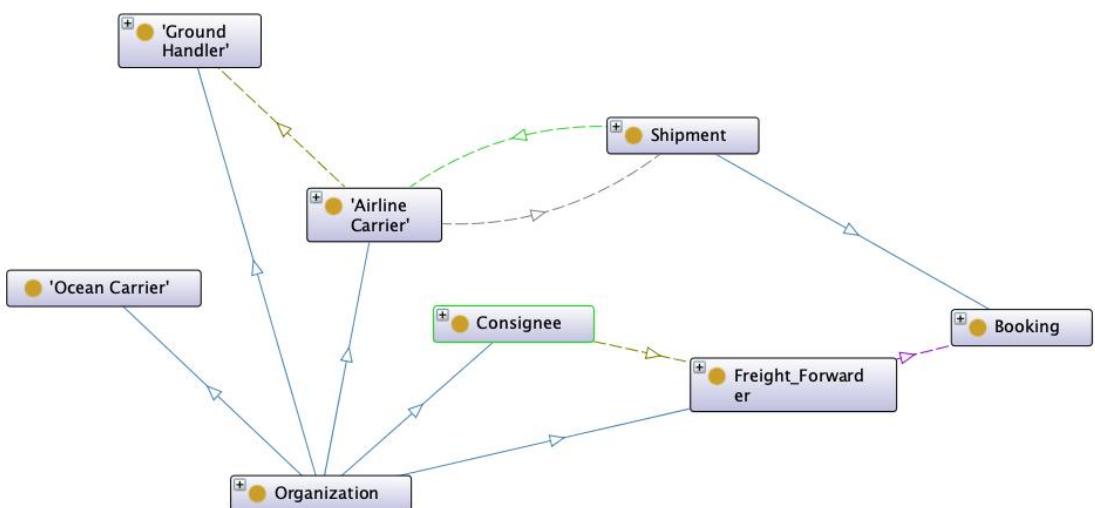
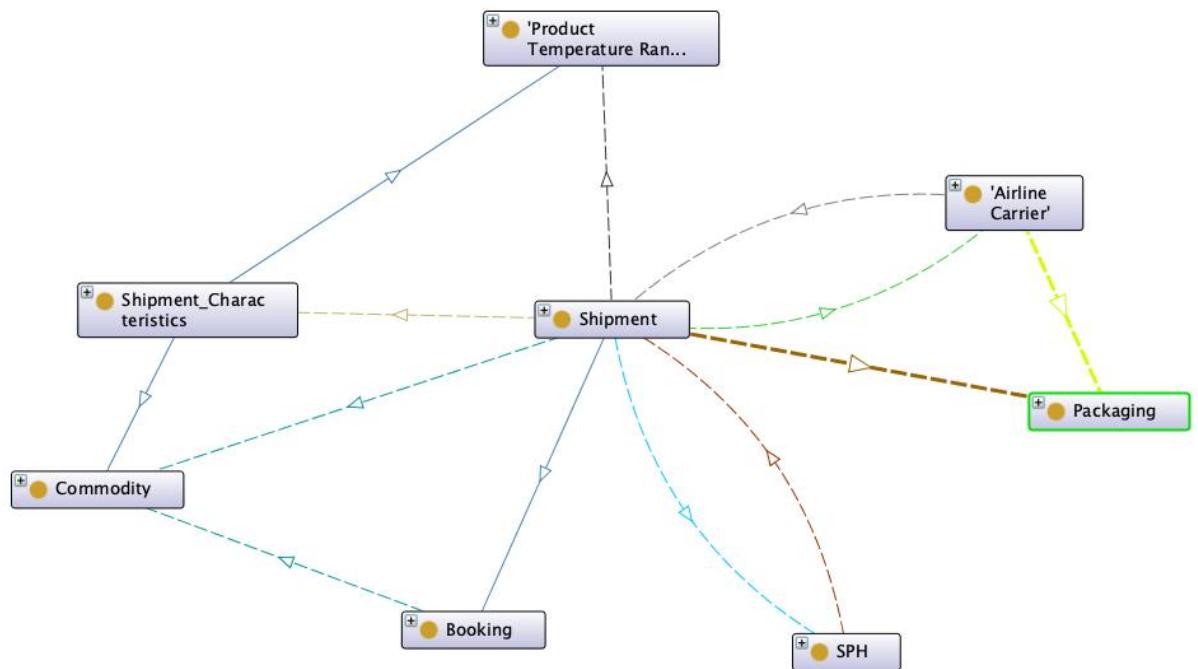
high security levels including on-site X-ray screening	yes	yes, this is an instance of the concept: monitoring
Good Distribution Practice (GDP) compliant and ISO 9001:2015 certified.	yes	yes, certification is incorporated
increase in temperature-sensitive products as well as the regulations related to their transportation, companies need to put more focus on control and security.	yes	yes, the triple is incorporated. temperature controlled capabilities, organizations and the relations.
pharma corridors offering “protection” across selected stations in its network for pharmaceutical cargo	yes	yes, instances of the concept : pharma capabilities
working with ground handling partners	yes	yes, relationship and concept incorporated: GHA and hires
handling operations for pharmaceuticals at these stations are “uniform”	yes	yes, (ground) handling is incorporated, and there is a relation to gha locations
stations comply with either European Union (EU) Good Distribution Practices (GDP) or IATA’s Centre of Excellence for Independent Validators (CEIV) pharma guidelines.	yes	yes, pharma certification is incorporated
provide a supplementary protection of product integrity during transport of temperature sensitive pharmaceutical cargo	yes	yes, this is an instance of packaging

dual cargo terminals at Dubai International Airport and Dubai World Central airports, plus the interconnecting trucking operations, were certified as compliant to EU GDP guidelines	yes	yes, these are instances of certification, airports, and trucking
essential to work with our partners on the ground	yes	yes, GHA are incorporated, and how they cooperate in the domain
right from the point the cargo gets dropped off at the origin airport until it is collected at the destination airport.	yes	yes, origin and destination is linked to airport
exploring the roll out of dedicated pharma flights across our network.	yes	partly, pharma capabilities are incorporated but not direct to flights
transportation of a rare rhino via Singapore Airlines Cargo	yes	yes, these are instances of airlines and the commodity live animals
comply with the Washington Convention on International Trade in Endangered Species.	yes	yes, this is an instance of the concept certification
delay the flight out of Brussels. This way we were able to reduce the transit time in Singapore and the overall travel time for the rhino to a minimum.	no, too specific for the structural approach of this ontology	no
very experienced veterinarian who accompanied the shipment	yes,	yes, trained personnel is incorporated.

Appendix J: Screenshots



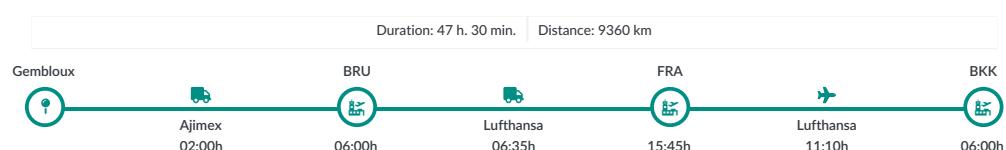




Appendix K: Case with Correlating Concepts and Relations – PART 1



Lane Assessment LH-BRU-FRA-BKK



Shipment details

Product Details	Commodity Type	Product Temperature Range	Packaging	Packaging Manufacturer
	Pharmaceuticals	Same as booked	Thermal Passive System (PAS)	
Booking Details	Primary Carrier LCAG	Booked Temperature Range +2 °C to +8 °C (COL)	Product Booked -	Incoterms -

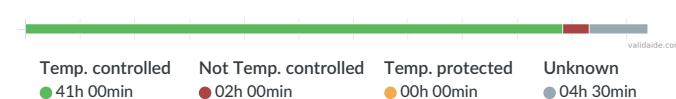
Comment

All pharmaceutical products booked as temperature controlled, will be handled in accordance to the pharmagrade service and to the Cargo Handling Manual.

As agreed these shipments meet all the requirements of IATA chapter 17 through all transit points.

(Overall this will cover: temperature check and or recording in cold rooms / temperature alarm systems in cold rooms / track and trace of shipments and Risk Score / Swot is available).

Temperature Exposure Overview



Risk Assessment

Overall	January	July
2.7	2.7	2.7

Average per risk



Disclaimer

This Lane Risk Assessment has been created by CEVA Logistics based on our best effort to collect and review relevant information from suppliers and other third parties. However, we cannot make any representations or warranties as to the accuracy or completeness of data from external parties and actual performance on the lane may be subject to change and contingency. As such, any rights with regards to the integrity of the content outlined in this document are disclaimed.



Lane Assessment

LH-BRU-FRA-BKK

Temp. Range (2 °C to 8 °C)

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Timeplan

Timeplan Graphical



Exposure Overview

	Duration
Temp. controlled	41:00h
Not Temp. controlled	02:00h
Temp. protected	00:00h
Unknown	04:30h

Timeplan Overview

Total Duration 47 h. 30 min.

Pick Up Point	Gembloux, Belgium	Duration 00:00h
Road Transport	Ajimex	Duration 02:00h
Road Transport	Low Security Threat Temp. controlled	Temp. controlled ① 02:00h
Ground Handling BRU	Swissport / BRU Station B704 IATA CEIV Pharma	Duration 06:00h
Offloading	Temp. controlled ① 00:30h	
Storage	Temp. controlled ① 02:15h	
ULD Buildup	Temp. controlled ① 00:45h	
ULD Storage	Temp. controlled ① 02:00h	
ULD Loading	Temp. controlled ① 00:30h	
Road Service LH 7681 from BRU to FRA	LCAG 23:40 BMT 22:40 UTC 06:15 CEMT 05:15 UTC M T W T F S S No Air Carrier Product selected	Duration 06:35h
Road Transport	Road (RFS) Surface Equipment-Road Feeder Service (Truck) 5 °C	Temp. controlled ① 06:35h
Transfer Handling FRA	LCAG / Lufthansa Cargo Cool Center LCCC IATA CEIV Pharma GDP	Duration 15:45h
ULD Offloading	Unknown ① 00:30h	
ULD Storage	Temp. controlled ① 03:45h	
ULD Breakdown	Not Temp. controlled ① 01:00h	
Storage	Temp. controlled ① 03:45h	
ULD Buildup	Not Temp. controlled ① 01:00h	
ULD Storage	Temp. controlled ① 03:45h	
Tarmac & Loading	Unknown ① 02:00h	
Flight LH 772 from FRA to BKK	LCAG 21:00 CEMT 20:00 UTC 14:10 BMT 07:10 UTC M T W T F S S No Air Carrier Product selected	Duration 11:10h
During Flight	Passenger (Widebody) Airbus A340 5 °C	Temp. controlled ① 11:10h

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Lane Assessment

LH-BRU-FRA-BKK

Temp. Range (2 °C to 8 °C)

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Ground Handling BKK

BFS - BKK / BKK Station

Duration 06:00h

Tarmac & Offloading	Unknown Tarmac Protection	Unknown	⌚ 02:00h
ULD Storage		Temp. controlled	⌚ 00:00h
ULD Breakdown		Temp. controlled	⌚ 00:30h
Storage		Temp. controlled	⌚ 03:00h
Loading		Temp. controlled	⌚ 00:30h

Total Duration 1 day. 23 h. 30 min.

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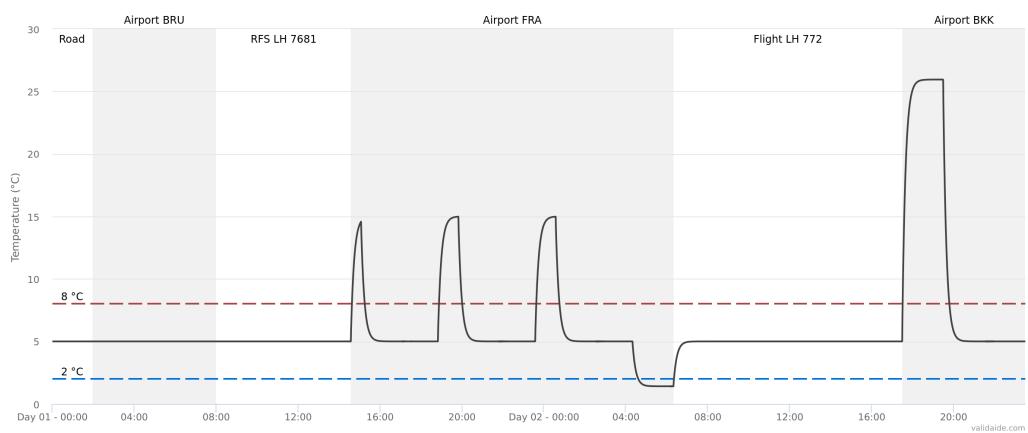
Lane Assessment
LH-BRU-FRA-BKK

Temp. Range (2 °C to 8 °C)

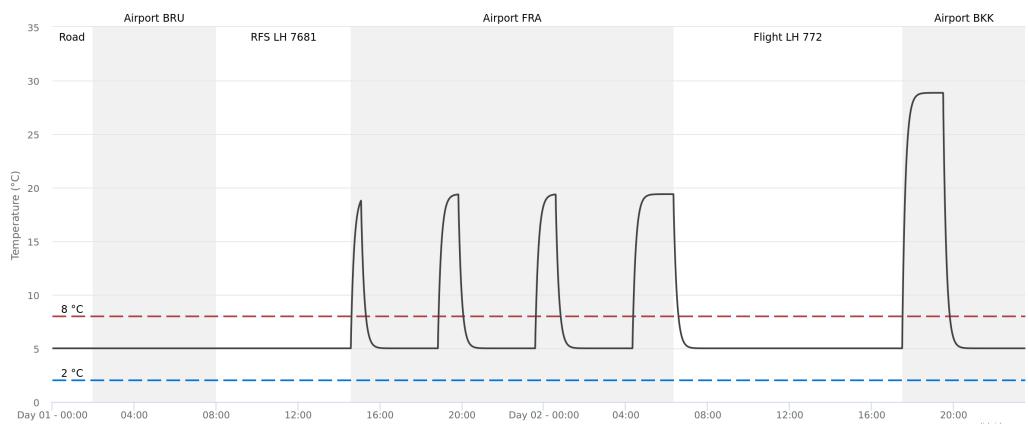
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Temperature Graph

Predicted Ambient Temperature for January



Predicted Ambient Temperature for July



Temperature Analysis January

Classification	Time
Critical warm	02h 01min
Major warm	02h 40min
Minor warm	00h 30min
In Range	40h 35min
Minor cold	01h 44min

Temperature Analysis July

Classification	Time
Critical warm	06h 01min
Major warm	01h 04min
Minor warm	00h 31min
In Range	39h 54min

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Lane Assessment
LH-BRU-FRA-BKK

Temp. Range (2° C to 8° C)

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Risk Assessment



Ambient Temperature Risk

Ambient Temperature Risk is based on the predicted average temperature profile for a shipment.

		January	July
	Road Transport Ajinex (Ajinex)	Insignificant	Insignificant
	Ground Handling BRU Swissport International Ltd. (Swissport)	Insignificant	Insignificant
	Road Service LH 7681 from BRU to FRA Lufthansa Cargo AG (LCAG)	Insignificant	Insignificant
	Transfer Handling FRA Lufthansa Cargo AG (LCAG)	Medium	Critical
	Flight LH 772 from FRA to BKK Lufthansa Cargo AG (LCAG)	Insignificant	Insignificant
	Ground Handling BKK Bangkok Flight Services (BFS - BKK)	Critical	Critical



Quality Management Risk

Risk of handling errors, infrastructure failure or other quality related problems.

	Road Transport Ajinex (Ajinex)	Minor
	Ground Handling BRU Swissport International Ltd. (Swissport)	Insignificant
	Road Service LH 7681 from BRU to FRA Lufthansa Cargo AG (LCAG)	Insignificant
	Transfer Handling FRA Lufthansa Cargo AG (LCAG)	Insignificant
	Flight LH 772 from FRA to BKK Lufthansa Cargo AG (LCAG)	Insignificant
	Ground Handling BKK Bangkok Flight Services (BFS - BKK)	Medium

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Lane Assessment
LH-BRU-FRA-BKK

Temp. Range (2° C to 8° C)

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Risk Assessment



Security Risk

Risk of cargo theft.

Road Transport Ajinex (Ajimex)	Critical
Ground Handling BRU Swissport International Ltd. (Swissport)	Minor
Transfer Handling FRA Lufthansa Cargo AG (LCAG)	Critical
Ground Handling BKK Bangkok Flight Services (BFS - BKK)	Insignificant



Delay Risk

Risk of delay due to flight or customs clearance delay.

Road Service LH 7681 from BRU to FRA Lufthansa Cargo AG (LCAG)	Medium
Flight LH 772 from FRA to BKK Lufthansa Cargo AG (LCAG)	Medium

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PART 2: Correlated Concept and Relations

Concept and Relation	Explanation
Booking is a subclass Shipment, Booking is transport by ‘some’ transport	This is the starting point, there is a shipment that needs to be shipped, in this case by air. This is incorporated by booking (Booking is the actual arrangement of the shipment)
Pharma	This type of cargo is a fundamental aspect that is distinctive from other types of cargo. There is Pharma Solutions, Pharma Goods as well as capability relevant to it.
Booking has ‘exactly 1’ Route. Route has destination/origin ‘some’ country. The route consist of different parts: Legs – Truck and Flight	As the shipment is going to out, it has a origin and destination. Different legs, Flight has airport as origin and destination.
Pick Up Point ‘route has origin’	The origin of the shipment can also be the pickup point.
Shipment has commodity type ‘some’ commodity has temperature ‘exactly 1’ Product Temperature Range	The shipment has a commodity type, in this case pharma, and this ‘commodity type’ or product has a product temperature range, in this case 2 to 8 or ‘cool temperature range’.
Shipment is packed in ‘some’ packaging	The pharma shipment is packed in passive packaging
Temperature, Ambient, Product, Booked	The temperature is a reoccurring concept throughout this case.
Duration of flights/road/route	This attribute reoccurs in the time plan, as this can effect certain decision (e.g. shorter times are preferred).
Ground Handling - (GHA executes ‘some’ ground handling capability) – (GH capability is available at ‘some’ tarmac) - Different Handling	In the time plan, the ground handling, its executor, its location and its different types is discussed
Hub and its Minimum Connection Time <i>This is newly implemented due to this assessment</i>	A hub is the part where transit occur, and they require a minimum connection time in order to make the transfer.

Freight Cut Off Time <i>Newly implemented attribute as synonym of minimum acceptance time</i>	This was discussed orally amongst the engineer and the expert, as they indicated this is a synonym for minimum acceptance time.
Delivery Time <i>Newly implemented</i>	The expected time of delivery
Preferred Space Access <i>Newly implemented concept as synonym of priority boarding</i>	This was discussed orally amongst the engineer and the expert. There is a difference between guaranteed space on an aircraft, and to have fast boarding. This is why this concept is incorporated.
Combination of Solutions and Different Speed Solutions <i>Newly implemented relation</i>	This was discussed orally amongst the engineer and the expert. In the airfreight business, different products can be combined e.g. pharma with speed.
Air carrier Service <i>Newly implemented synonym for solution</i>	This was discussed orally amongst the engineer and the expert, they argued that this was the main concept for products that air carrier offer
Temperature Controlled Capabilities is executed by ‘some’ (Aircarrier or Ground handler) Or Ground handling Capability is Temperature Controlled	Throughout the time plan, the temperature controlled concept reoccurs. There are different capabilities that deal with temperature, as well as different handling that have to be temperature controlled.
Risk and its types	In the last parts of this case, the different risk types are discussed. As shipper want as less risk as possible, it is vital this is implemented
Carrier	A vital concept in the case as well as the ontology, as they ship the products.
Temperature Controlled Compartment <i>Rephrased from airconditioned Compartment</i>	As temperature controlled is a reoccurring aspect throughout the time plan, this also accounts for the flight, therefore should be incorporated
Airport as a reoccurring concept	This concept occurs multiple times in multiple relations. E.g. where the flight lands,
Tarmac	This is where ground handling takes place
Flight has operating day ‘some’ operation day	In the time plan, it shows which days a flight occurs.