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How to enhance logistics operational efficiency by improving the contract carrier's safety culture

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Description
Safety culture is a crucial aspect of any business organisation. This is why non-compliance with safety rules as well as insufficient instructions cause multiple disruptions in logistics operations in addition to health and property damage. Due to globalization, it is more difficult to perform information exchange and manage this process effectively over a vast network of companies. However, any sustainable organization should be able to guarantee the occupational safety and health of all parties involved in its operations.

The objective of the work was to ensure contract carriers compliance with the safety rules at the UPM Kaipola paper mill in order to improve the efficiency of its logistics processes. The task was to determine the reasons for safety violations by foreign drivers supplying raw materials to the plant and plan the arrangements to prevent risks related to safety issues. The idea was to perform risk assessment of the main working areas and employ root cause analysis to determine the origin of the problems based on information collected by means of a content analysis of the UPM safety regulations and instructions and by using non-participant observation of the drivers' behaviour at the mill along with interviews. The result was a plan to establish regular communication with the different parts of the supply chain, and with the foreign carriers in particular, in order to develop complete multilingual instructions and guidelines. Moreover, the plan was to provide for their availability and visibility to the drivers and assign a responsible person to control compliance with the safety rules. With the help of this work, the case company can create an efficient safety management system involving systematic risk evaluation and control, updated safety guidelines and regular information exchange with the different parts of the supply chain. This is hoped to guarantee the health and safety of the company's employees and improve its logistics performance.

Keywords
Safety culture, Occupational safety and health (OSH), Safety management system (SMS), Risk evaluation and control

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Abbreviations and definitions

RCP	Recovered paper (old newsprint recycled and used for manufacturing of new paper products)
CP	Chemical pulp (man-made cellulose – mix of wood chips and chemicals)
KAI4, KAI6, KAI7	Paper machines 4, 6 and 7 at UPM Kaipola plant
LTAF	Lost-Time Accident Frequency (time from the moment accident occurred to the recovery)
TRIF	Total Recordable Injury Frequency (total number of lost-time injuries per million working hours)
NHS	National Health Service
OSH/OHS	Occupational Safety and Health
ILO	International Labour Organization
EU-28	28 member countries of the European Union
EMR	Experience Modification Rate (a number used by insurance companies to gauge both past cost of injuries and future chances of risk)
ERP	Enterprise Resource Planning
SMS	Safety Management System
RCA	Root Cause Analysis (a combination of tools aimed to identify the true cause of a problem and the actions necessary to eliminate it)
PPE	Personal Protective Equipment
Heavy traffic	Both truck and combined vehicle traffic as well as rail traffic

1 Introduction to the case

1.1 Big picture

In today's world, the globalization process and common use of outsourced services result in creating massive networks of companies whose operations are dependent on each other. In such conditions, they have to manage more than five different supply chains all over the world, and it is challenging to ascertain that everything goes as planned. It often causes insufficient communication between various hubs so that such important aspects of any business as safety go into the background and are difficult to control. In the long run, this fact has a negative impact on the operational efficiency of a company and leads to disruptions in logistics. This UPM case study aimed to reveal those effects, find the reasons and make development proposals for the existing safety management system. (Waters 2011, 11-13.)

1.2 UPM in brief

The thesis was carried out for the UPM-Kymmene Corporation – a Finnish company that integrates bio and forest industries, in particular, for its paper mill located in Kaipola (Jämsä). In general, depending on the different types of the company's operations, there are several major subdivisions:

- UPM Biorefining – pulp, timber and biofuels
- UPM Energy – low-emission energy generation
- UPM Raflatac – self-adhesive label materials
- UPM Speciality papers – label papers and high-end office papers
- UPM Paper ENA – graphic papers
- UPM Plywood – plywood and veneer products

The Group employs around 19 600 people, and it has production plants in 13 countries. The factories are located all over Finland, but in this case the main focus was on the business operations conducted in the UPM Jämsä River mills which consist of two units: one in Jämsänkoski specialized in manufacturing uncoated

magazine paper and label papers, and another one in Kaipola producing coated magazine paper, directory paper and newsprint. (UPM Jämsä River Mills 2015, 2.)

1.3 UPM Kaipola current situation

There are two UPM paper mills having a direct economic impact on the development of Jämsä region: in Jämsänkoski and Kaipola. All together they employ approximately 940 workers including contractors. The main raw materials used in the production are:

- Spruce
- Saw mill chips
- Recovered paper
- Chemical pulp

For their manufacturing operations they utilize six paper machines with the total production capacity of 1 370 000 tons per year, one de-inking plant which reuses 2/3 of the recovered paper in Finland and the company's own power plants which generate steam and electricity.

The factories specialize in producing:

- Printing papers for magazines, newsprint and directories
- Label papers and packaging papers

Over 80 % of their products go for export.

In Kaipola, they operate with paper machine 4 producing (7.04 m wide) directory paper out of thermos mechanical pulp and recovered paper, paper machine 7 and a de-inking plant for (8.40 m wide) newsprint and directory paper with the same kinds of raw materials. Moreover, they also have paper machine 6 making (8.26 m wide) coated magazine paper using thermos mechanical pulp, chemical pulp, pigments and binders.

1.4 Targets and KPIs

There are four main goals for the company in general, and therefore its plants in Jämsä strive to achieve:

1. **Absolute safety** – operation with zero accidents
2. **Customer satisfaction** which comes from production efficiency and sufficient product quality
3. **Cost effectiveness** via circular economy and value creation
4. **Environmental friendliness** – responsible use of water and resources plus waste management

In order to evaluate how these objectives are followed, UPM uses several Key Performance Indicators (KPIs) and measures for each of them. These indicators are divided into four sections in accordance with the focus areas of the company's business. The information in Appendix 1 is related to May 2017. Since the evaluation figures are not to be disclosed as they belong to the confidential data of UPM, the measures are rated and categorized as weak (red), improved (yellow) or target (green). Some indicators, such as customer claims or power index, are assessed individually for each paper machine operated in the Kaipola mill as the figures vary greatly, which is why the machines are represented in the table with abbreviations according to their numbers: KAI4, KAI6 and KAI7 (see Appendix 1). It demonstrates the current level of performance from different perspectives. Development and improvement needs are especially evident in the area of safety as all the related measures are evaluated as weak or rather improved.

1.5 Preconditions

The trigger of the increased attention to occupational safety was the accident occurred in UPM Shotton's recovered-fibre warehouse in Deeside, the UK. As a result of security breaches, a worker was struck by a large bucket loader driven by another contract worker. Consequently, it led to his death and halting of logistics operations. This tragic event happened six months after UPM's Shotton paper mill was lauded for

passing the milestone of five years of operation without any lost time accidents. (UPDATED: Man killed at UPM paper mill 2017.) After this incident and another potential one that occurred in Kaipola (a not properly picked up unstable pile of RCP fell down right behind a contract worker who was too close to the lifting grabbers of the vehicle), the wheel loaders were equipped with cameras so that their drivers could see what was going on in front when they had the load lifted.

According to the UPM Annual Report 2016, there were also two fatal accidents in the previous year. One of them involved a Finnish employee at a Finnish paper mill and another a contractor in the UPM operations in Uruguay during forestry work. (UPM Annual Report 2016, 45.)

However, the company drives continuous improvements in safety and strives to become a leader in this area. Statistically, according to safety manager Risto Elo (2017), in the previous years incidents occurred in the UMP Kaipola more frequently. For example, in 2010-2012 there were 30-40 accidents per million working hours, and due to constant enhancement of safety management by 2016, this number was reduced to five. By the end of May 2017, three accidents had already happened, which meant approximately six accidents per million working hours. Even though the company has made a considerable progress in safety, one of its main targets is to operate with zero accidents.

2 Research bases

According to Khan (2011), ***research*** means a search for facts, answers to questions and solutions to problems through the application scientific methodology. Therefore, before starting the research, the objectives of the study are to be clearly stated.

2.1 Objective and questions

The research work aimed to ensure contract carriers' compliance with the safety rules. Frequent safety violations, such as not wearing special protective equipment, smoking on the paper mill site, walking around the premises without permission and

other violations mainly by Russian speaking drivers transporting raw materials are examples of incidents lately observed. Due to the lack of permanent contacts with the suppliers and common language between the drivers and operators it is challenging to establish communication and determine the reasons for such behaviour.

Guided by the main objective, three key research questions were defined for this case study:

- How are the drivers instructed in terms of safety?
- How is the communication between the drivers and UPM operators conducted?
- How to monitor the drivers' activity and ensure their following of the established safety norms?

These questions were supposed to address the reasons for the violations and consider possible solutions for the problems.

2.2 Boundaries

The research is limited by two operations:

- Recovered paper (RCP) from Russia to Kaipola delivered by Russian trucking companies. On average, there are 20-25 trucks daily delivering the material to the mill warehouse.

RCP includes magazines, newspapers, brochures, advertising material or any other paper publications. In Kaipola, the capacity is approximately 540 tons per day. The finished product contains approximately over 50% of de-inked, renewable fibre.

- Chemical pulp from Stora Enso to Kaipola is transported by contract carriers, such as VR Transpoint, DB Schenker and Perälä using the services of Russian speaking drivers. On average, there are 30 trucks (meaning approximately 1 200 tons of material supplied) coming to Kaipola per week via different transport operators.

Chemical pulp (man-made cellulose) is produced by combining wood chips and chemicals under high pressure. Kaipola monthly consumes about 5 000 tons of chemical pulp for paper production. The material is supplied in the form of big thick sheets, which are ground and pulped with water before feeding to the paper machine.

Figure 1 shows how the supply of these raw materials is organized. Production sites and warehouses are marked with squares. The blue arrows represent recycled paper and the orange one chemical pulp. There are also key carriers listed for each category of materials in relation to the units which arrange the transportation: Stora Enso (a supplier) is in direct contact with the carriers and responsible for chemical pulp carriage, whereas for recycled paper, UPM Russia organizes the supply from RCP warehouses located in different places using the services of Russian transportation companies.

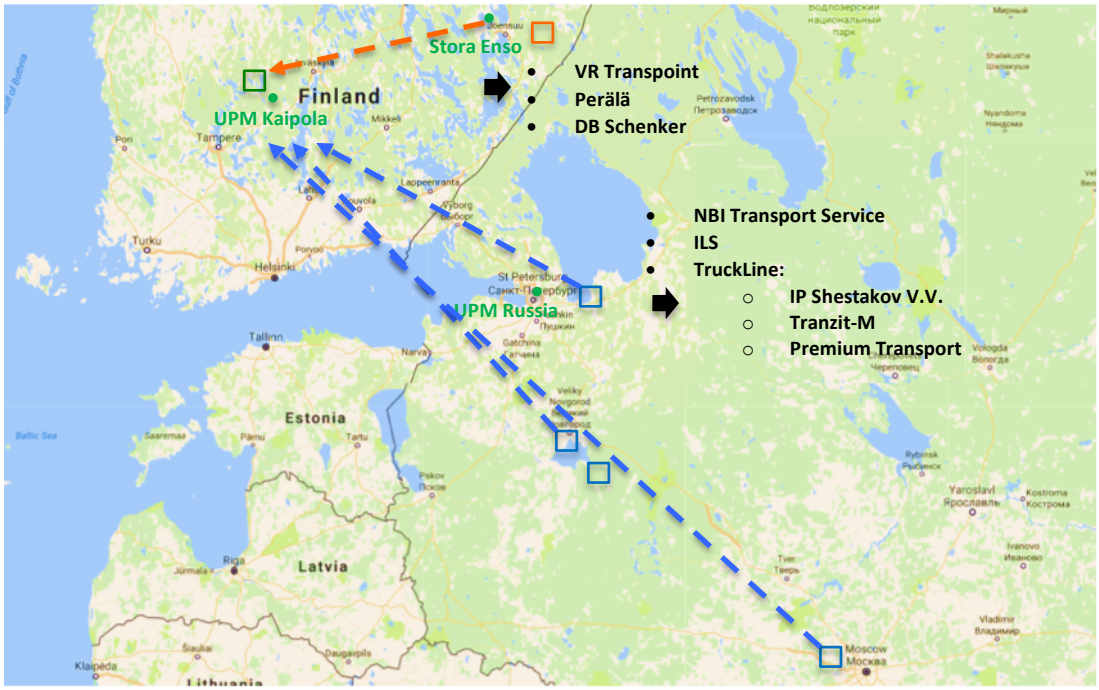

Figure 1. Supply chain map

Some safety instructions and general guidance translated into the Russian language had been sent to the UPM office in Saint Petersburg. However, there is no guarantee

that they finally reach the drivers and if they are actually being instructed. Finnish carriers are supposed to follow the Safety requirements for heavy traffic in the UPM Finland production plants. Moreover, drivers transporting to UPM for the first time should go through an online safety induction in order to receive a company authorized safety card. However, this process is also out of control, and it is not clear in which way international drivers receive the same kinds of instructions.

Between 2012-2016 the situation in terms of safety visibility was considerably improved especially at the receiving station and warehouse of RCP: there are special signs showing what kind of safety equipment the drivers must wear, memos with basic rules to be followed as well as guidelines on whom to contact in case of emergency. Nevertheless, there are still violations and difficulties in communication. Table in Appendix 2 represents how and through which hubs the general guidelines provided by UPM Kaipola go until they reach the drivers. The information flow varies based on the operation, but it consists at least of four levels. In this case Level 1 refers to UPM Kaipola passing safety directives to Level 2 represented by UPM Russia for RCP or rather the Finnish chemical pulp supplier, Stora Enso. From Level 2 they go to Level 3 – directly to the key carriers and/or the forwarding company, which is responsible for substitution carriers (Level 4) and thereafter for providing them with safety instructions. The carriers, in turn, undertake to instruct the drivers (Level 4 or Level 5). Such structure of information flow illustrates the vulnerability of the system, as it seems to be difficult to guarantee sufficient communication and data provision between different units. There is a high risk that the information is lost, incomplete or inaccurate on its way.

2.3 Approach and methods

At the beginning of any kind of project, the research approach and methods used for studying the subject have to be defined. They are supposed to help the researcher to find the most effective way to meet the objectives. ***Research approaches*** are plans and procedures for research projects that span the steps from broad assumption to detailed methods of data collection, analysis, and interpretation (Creswell 2014, 3). In

general, these approaches are divided into two main categories: ***quantitative*** and ***qualitative***. The difference is that the first one is used to quantify attitudes, opinions or behaviours within a large sample population via transforming collected numerical data into statistics, whereas the second one is more focused on understanding of underlying reasons and motivations and studying the problem more deeply while the sample size is typically small. (Wyse 2011.) However, there is also a ***mixed methods*** approach that involves collecting and integrating both quantitative and qualitative forms of data. The core assumption of this type of inquiry is that the combination of qualitative and quantitative approaches provides a more complete understanding of a research problem. (Creswell 2014, 4-5.) In this case, qualitative methods were used since the major goal of this study case was to define the causes of violations that required profound study of the established safety culture in the organization as well as employee behaviour and attitudes concerning this area. Methods of qualitative research include observation and immersion, interviews, open-ended surveys, focus groups, content analysis of visual and textual materials, and oral history (Crossman 2017). The decision was to concentrate on the following three methods:

- **Non-participant observation** is observation with limited interaction with the people one observes. This option is used to understand a phenomenon by entering the community while staying separate from the activities being observed. (Liu, & Maitlis 2010.) This method often involves the use of video or audio recording devices. The observer is interested in overseeing the actions of the subjects without influence on their behaviour as the aim of this strategy is to observe the operations in natural conditions and reveal their relevant issues. (Silverman 2016.) In this study case, conducting regular observations allowed to watch the normal working process of the drivers and note their violations.
- **Semi-structured reflective interview** is an interview in which the interviewer refers to a prepared interview guide that includes a certain number of questions. These questions are usually open-ended, but their order and form may vary depending on what is said by any individual respondent. It requires

highly developed listening skills from the interviewer to follow up and adjust the conversation. (Ruolston 2010, 15.) Interviewing the drivers and transportation companies was supposed to be the most effective way to create a temporary communication bridge between UPM and the contract carriers. Moreover, it should help to understand their awareness, different views of the current situation and attitudes towards complying with the safety rules established by UPM.

- **Content analysis** is a method of describing the meaning of qualitative material in a systematic way (Shreier 2012). Furthermore, Mayring (2010) gives a broader definition to qualitative content analysis as a set of techniques for the systematic analysis of texts of many kinds, addressing not only manifest content but also the themes and core ideas found in a text as primary content. Basically, it works on the principle that the more a topic is mentioned, then the more important it is considered to be. It is also used for quality comparison of data from different sources. (Crowther & Lancaster 2005, 183.) Content analysis of the UPM safety documents was necessary in order to define and summarize all the safety requirements applied specifically to the truck drivers and see how they were reflected in the instructions. Based on the results, it might also be useful to compare the guidelines of UPM and transportation companies to ascertain that there are no crucial differences or drawbacks.

This kind of research is called ***triangulation*** that refers to the use of a variety of methods with a view of exploring the objective from different angles (Davies 2007). There are four basic types of triangulation:

- Data triangulation (involves time, space, and persons)
- Investigator triangulation (involves multiple researchers in an investigation)
- Theory triangulation (involves using more than one theoretical scheme in the interpretation of the phenomenon)

- Methodological triangulation (involves using more than one option to collect data, such as interviews, observations, questionnaires, and documents) (Kennedy, 2009.)

The last one was selected for this thesis since it was based on observations, interviews and documents. The combination of these data collection methods was supposed to guarantee the authenticity of the collected information. Familiarization with the safety rules established in the company and used by the carriers through document studies was important for knowing what kinds of requirements existed for the various groups of employees and for defining possible differences or flaws. Moreover, the author needed to observe the operations in order to obtain the visual evidence of actual safety violations. The reasoning and more detailed information about the situation in transport companies could be acquired through direct interaction (interviews) with the drivers.

2.4 Root cause analysis

The information collected from the safety documents, observations and interviews needs to be processed. This chapter describes one of the most common techniques used for data analysis aiming to solve a root of a problem.

One of the ways to identify future risk is to ask questions about the reasons for occurring of such an event in the past. In theory after inquiring five times why, one should achieve an initial cause of an issue, in a formal way this method is called ***root cause analysis*** and defined as *a structured investigation that aims to identify the true cause of a problem and the actions necessary to eliminate it*. However, it has much wider meaning as it combines a number of different techniques, tools and approaches. The origin of root cause analysis can be traced to the broader field of TQM – total quality management that also includes problem analysing and solving. Root cause analysis is one of the core building blocks in an organization's continuous improvement efforts. (Andersen 2006, 21-22.) Used in reactive mode, it can prevent problems from recurring. Used in proactive mode, it can examine current operations

and help to identify areas and activities that can be improved. (Wilson, Dell, & Anderson 1993, 8.) There are many methodologies applying variable tools for conducting root cause analysis. The most common root cause analysis approaches are as followed:

- **Events and casual factor analysis** used for major, single-event problems when the evidence is obtained quickly and methodically to establish a timeline for the activities leading up to the accident;
- **Change analysis** applicable when a system's performance has shifted significantly;
- **Barrier analysis** focuses on what controls (physical, administrative and procedural) are in place in the process to either prevent or detect a problem (Okes 2009, 4-5);
- **Management oversight and risk tree (MORT) analysis** uses a tree diagram to examine what occurred and why it might have occurred, it lists on the left side of the tree specific factors relating to the occurrence and on the right side – the management deficiencies that permit specific risk factors to exist;
- **Human performance evaluation (HPE)** used to identify factors that influence task performance, focuses on operability and work environment (Resse 2016, 109);
- **Kepner-Tregue problem solving and decision making** provides a systematic framework for collecting, organizing, and evaluating information and consists of four basic steps for resolving problems: situation analysis, problem analysis, solution analysis and potential problem analysis (Okes 2009, 4-5).

  The structured summary of these root cause methods is represented in Figure 3 that describes in which cases the particular method is used, its pros and cons as well as specifies what should be taken into account when applying the method.

Method	When to Use	Advantages	Disadvantages	Remarks
Events and causal factor analysis	Use for multifaceted problems with long or complex causal factor chain	Provides visual display of analysis process. Identifies probable contributors to the condition.	Time consuming and requires familiarity with process to be effective	Requires a broad perspective of the event to identify unrelated problems. Helps to identify where deviations occurred from acceptable methods.
Change analysis	Use when cause is obscure. Especially useful in evaluating equipment failures	Simple six-step process.	Limited value because of the danger of accepting wrong, *obvious* answer	A singular problem technique that can be used in support of a larger investigation. All root causes may not be identified.
Barrier analysis	Use to identify barrier and equipment failures and procedural or administrative problems	Provides systematic approach.	Requires familiarity with process to be effective	This process is based on the MORT Hazard/Target Concept.
MORT/ Mini-MORT	Use when there is a shortage of experts to ask the right questions and whenever the problem is a recurring one. Helpful in solving programmatic problems	Can be used with limited prior training. Provides a list of questions for specific control and management factors.	May only identify area of cause, not specific causes	If this process fails to identify problem areas, seek additional help or use cause-and-effect analysis.
HPEs	Use whenever people have been identified as being involved in the problem cause	Thorough analysis.	None if process is closely followed	Requires HPE training.
Kepner–Tregoe	Use for major concerns where all aspects need thorough analysis	Highly structured approach focuses on all aspects of the occurrence and problem resolution.	More comprehensive than may be needed	Requires Kepner–Tregoe training.

Figure 2. Summary of root cause methods (adapted from Resse 2016)

Figure 2 illustrates that certain methods are used for different circumstances. However, in general, the whole analytical process can be completed in four major stages:

1) Data collection

   Without complete information and an understanding of the event, the casual factors and root causes associated with the event cannot be identified

2) Casual factor charting

   A sequence diagram with logic tests that describes the events leading up to an occurrence and the conditions surrounding these events

3) Root cause identification

This process starts after all the casual factors are identified. It involves the use of a decision diagram called the Root Cause Map to identify the underlying reasons for each casual factor

4) Recommendation generation and implementation

   Following identification of the root causes for a particular causal factor, achievable recommendations for preventing its recurrence are then generated. (Rooney, & Vanden Heuvel 2004, 46-49.)

Root cause analysis often involves applying a variety of tools, either in sequence or in multiple iterations using the same tool (Andersen 2006, 23-25).

In order to understand the principle of how these tools work in practice it is useful to select some of them and describe them more specifically. The seven key tools as defined by the American Society for Quality are the ***flowchart*** for graphically depicting a process, ***Pareto chart*** for identifying the largest frequency in a set of data, ***Ishikawa diagram*** for graphically depicting causes related to an effect, ***run chart*** for displaying occurrences over time, ***check sheet*** for totalling count data that can be later analysed, ***scatter diagram*** for visualizing the relationship between variables and ***histogram*** for depicting the frequency of occurrences. A few of those were used in the current case study. Therefore, it is useful to provide their detailed description.

The first important matter to understand the problem is to know how the specific operation is organized step-by-step. ***Flowchart*** is used to describe a process. It uses symbols to represent activities and decision points in a process (see Figure 3): oval – start and end of a process, rectangles – its individual activities, diamond – yes or no decision and lines with arrows depict the flow of a process. (Brassard & Ritter, 2010)

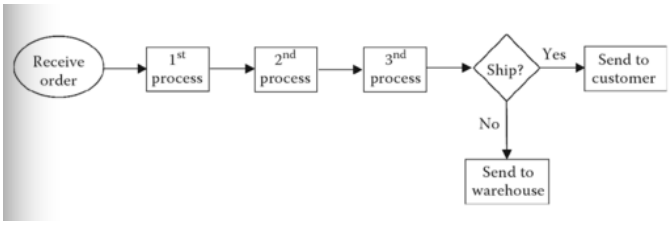

Figure 3. Flowchart (adapted from Barsalou 2015)

A root cause investigator can use a flowchart to map a process and thereby gain a better understanding of factors relating to the process. For instance, a root cause investigator searching for the root cause of sporadic defective parts from a production machine may create a flowchart of the manufacturing process from the input of raw materials to the completion of the finished parts. A flowchart is particularly useful for process-related failures, such as when a quality manager must determine the root cause for order being improperly entered into ERP system. (Barsalou 2015.)

In the case under study it was essential to understand what process steps the driver went through after arriving at UPM Kaipola in order to define at which stage there was a lack of control or the driver simply had difficulties to do his job. Those were the stages at which safety risks were high.

Check sheet is another tool usually used for prioritization of a root cause investigation. It helps to quantify failure data and identify what kind of events happen more frequently. Figure 4 represents the traditional cheek sheet consisting of failure type, marks of the event occurred and the total number of them.

Failure	Number of Occurrences	Total
Part missing	~~////~~ ~~////~~ //	12
Scratches	~~////~~ ~~////~~ ~~////~~ ~~////~~ /	21
Dimensional problem	~~////~~ ~~////~~	10
Wrong part	~~////~~ ~~////~~ /	11
Improper assembly	~~////~~ ///	8
Assembly problems	~~////~~ /	6
Total		68

Figure 4. Check sheet (adapted from Barsalou 2015)

Check sheet was a simple and effective method for listing all the observed safety violations and marking every time when they were noticed. That way the researcher was able to analyse the occurrence of each violation and reveal the critical ones.

Figure 5 shows another example of the use of a check sheet to determine the cause of lower sales per day than budgeted in a bookstore, which is located in the large shopping mall. In order to understand why the customers came to the store to browse but not buying anything, during a two-week period the staff was asking each client who left without purchase why this happened. (Andersen, & Fagerhaug 2006.)

Cause of no purchase	Week 1	Week 2	Total number of occurrences per cause
Could not find item	~~////~~ ~~////~~ ~~////~~ ///	~~////~~ ~~////~~ ~~////~~ ~~////~~	37
No offer of help	~~////~~ ~~////~~ //	~~////~~ /	18
Item sold out	//	///	5
Item not carried	///	~~////~~ /	9
Prices too high	/		1
Line too long	/	///	4
Wrong credit cards	//		2
Poor lighting	~~////~~ //	~~////~~ ~~////~~ //	19
No place to sit	//	////	6
Total number of causes per week	48	53	101

Figure 5. Check sheet example – Bookstore (adapted from Andersen & Fagerhaug 2006)

In 37 out of 101 cases (36.6 %), the reason was not finding the item which means that there is either a little range of books sold in the store or a poor organization of them on the shelves.

Data from check sheet can be analysed using run charts. ***Run chart*** is applied for monitoring process performance over time to detect trends as well as allowing an analyst to compare a performance measure before and after implementation of a solution.

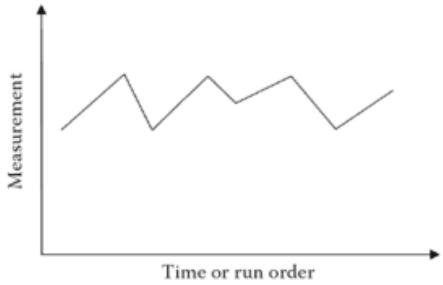

Figure 6. Run chart (adapted from Barsalou 2015)

In Figure 6 the x-axis is used to indicate time, which increases from left to right and the y-axis, is where the measurement results are placed, for instance, the number of accident occurrences per day for the period of one week. (Barsalou 2015, 29.)

Run charts are useful in understanding if enhancement work has a significant impact on the measure to be improved. Consider Figure 7, which shows patient waiting times in a Renal Outpatient Clinic. There are no shifts (eight points consecutively above or below the median) and no trends (six points consecutively increasing or decreasing). Therefore, the process shows common cause variation and is in statistical control. (Harrison 2012, 6.)

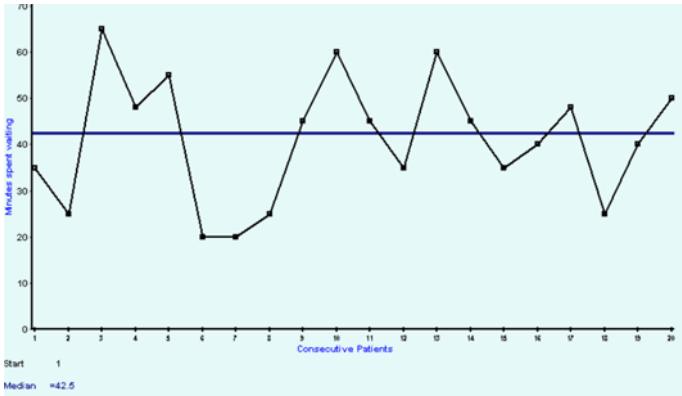

Figure 7. Run Chart example – Patient Waiting Times in a Renal Outpatient Clinic I (adapted from Harrison 2012)

The team then decides to introduce a new booking schedule and continue recording patient waiting times. The median line is fixed at 42.5. These results are then plotted on a new run chart with our baseline data in Figure 8. (ibid., 7)

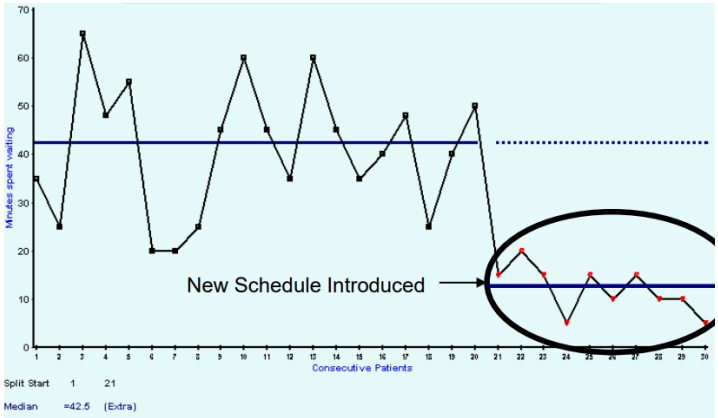

Figure 8. Run Chart example – Patient Waiting Times in a Renal Outpatient Clinic II (adapted from Harrison 2012)

Figure 8 shows that there has been a shift shown by the oval – with a run of ten points below the median. The chart is no longer in control and therefore a statistically significant change has occurred. The New Schedule Introduced change in schedule has resulted in a considerable reduction in waiting times. (ibid., 7-8.)

In the study case the idea was for the period of three month (from the middle of May to the middle of August 2017) with weekly observations to see the trend of violations occurrence before and after some improvements were done. This way the researcher could understand if the correction actions were effective or not.

The last but not the least important tool to be used is ***Ishikawa diagram*** or so-called fish bone diagram due to its schematic representation. It consists of the horizontal line leading to the effect on the right side and several inclined lines along this core labelled with the potential factors. Traditionally analysts list the factors as six Ms: man (power), material, milieu (alternatively environment), methods, machine and measurement. (See Figure 9) *Material* describes factors related to raw materials and information issues, *method* is associated with the operational processes and their organizational inefficiencies, *machine* – equipment, systems and machinery failures, *man* means physical or knowledge work, cultural particularities and coordination problems, *measurement* is related to the insufficient evaluation and control of the operations and *environment* – external factors causing disorders. Each of the angled lines should have a description with influences of each factor. For example, it could be high temperature in case of environment, lack of training – in manpower or component damage – in machine.

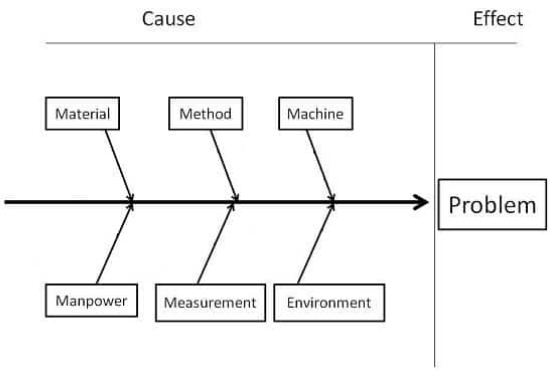

Figure 9. Ishikawa diagram (adapted from Barsalou 2015)

Since this kind of diagram is aimed to define the reasons for a certain impact, it often can be found in literature as cause-and-effect chart.

Figure 10 shows an example of its use in a company operating cable television services, which has a consistently high level of employee absenteeism, especially in the installation and service department. This has already led to a number of negative consequences such as extra costs, longer service time and, as a result, angry customers. In order to improve situation, human resource manager and some service personnel arranged brainstorming session to generate the ideas about this phenomenon, to sort the relevant ones, the team analysed all ideas and grouped the causes on the chart.

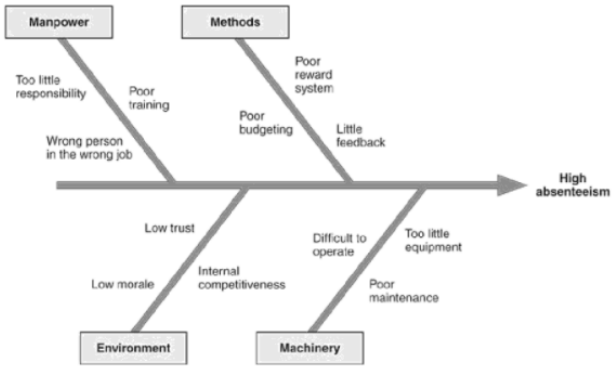

Figure 10. Cause-and-effect chart example – Cable Television Company (adapted from Andersen & Fagerhaug 2006)

The results made the company consider training programs, reward systems and increasing the quality of the tools and equipment used by the service personnel. (Andersen & Fagerhaug 2006.)

In this case study, after analysing the reasons for violations based on safety document studies, interviews and observations, it was useful to divide them into different factor groups in order to understand what kind of working parameters mostly influenced occurring of the certain violation and which of them should be primarily fixed.

There are many other tools supporting different steps of root cause analysis, however, the combination of four presented can already provide diverse and profound processed information for further solution proposals.

3 Safety culture

This chapter is aimed to define the terms of safety culture and demonstrate its importance in the operation of each organization.

3.1 Definition and key elements

First of all, it is worth to uncover the concept of safety. According to Dr Stian Antonsen (2016, 7.), it consists of three elements that refer to:

1. A *state* or *situation* where the statistical risk is deemed to be acceptable or as low as reasonably practicable
2. A *feeling* of security and control
3. A *practice* associated with our ability to reduce or eliminate the likelihood of hazardous events occurring

It is also important not to be confused with two terms *safety* and *security*. Both of them have their origins in the area of IT – generally they are used to characterize computer systems. In simple words *safety* is the condition of being protected from harm whereas *security* is the process of ensuring safety.

Occupational safety has even more narrow meaning since it relates particularly to unintended accidental events that occur in work organizations. Safety regulations established in a company are supposed to give quite detailed guide for action and behaviour to the employees. However, the question is how in fact sufficient and visible they are for each worker that is reflected in the term *safety culture*. It originated in 1986 in the process of cause and effect analysis of the Chernobyl accident conducted by the International Atomic Energy Agency. The deficient safety culture was recognized as the main root cause of the explosion in reactor. (ibid., 10.)

The concept of safety culture basically refers to the way of behaviour adopted in the organization in terms of safety that does not necessarily represent the rational model of action. The cultural frames of reference include a set of shared perceptions of what

is considered to be safe and what dangerous. The more widely shared these assumptions are the less the organization's ability to detect signals of danger that fall outside these frames of reference. (ibid., 13.)

The *safety culture* is an integral part of the overall production culture and is a combination of the administration activities and the behaviour of personnel aimed at ensuring the safety of potentially hazardous industries and facilities.

The safety culture of an organization should be based on the following key principles:

- Awareness by each employee of the importance of ensuring safety
- Responsibility of each employee, realized through understanding and rigorous execution of job descriptions
- High level of knowledge and competence of managers providing personnel training and implementation of security measures
- Regular supervision and control over the state of the systems responsible for the safety of the enterprise and the training of personnel

As well as all areas of company's business, safety culture should be somehow managed and developed in the long run. Safety management system is usually created for that. In general, it stands for minimizing injuries. In addition, a reliable management system can increase efficiency; improve productivity, morale, quality of products and etc. (Roughton, Mercurio, & James 2002, 3.) Besides it is also important to remember that a correct safety balance cannot be achieved unless acceptable and unacceptable conditions are established early enough in the program to allow the selection of the optimum design solution and operational alternatives (Antonsen 2016, 14). Unfortunately, the importance of creating a comprehensive, well-managed safety and health program that supports the management system is often underestimated. The main reason is that not all effects and costs associated with the incidents are often taken into account. That is why it is worth illustrating this idea in the chapter 3.4.

3.2 Cultural dimensions

The concept of safety culture is perceived differently depending on the country it applies to as cultural particularities affect *the attitude of people towards complying with the rules*. Indeed many researches, which prove that the relationship to different aspects of life largely depends on the kind of environment in which a person grew up, have been recently conducted. One of such brainstorming theories was introduced by a Dutch social psychologist – Geert Hofstede, who defined culture as *the collective programming of the mind, which distinguishes the members of one group or category of people from another*. He claimed that culture is learned derived from one's social environment so that it cannot be inherited. (Hofstede 2010, 4-7.) There are several layers of culture which influence human personality's formation:

- a **national level** according to one's country (or countries for people who migrated during their lifetime);
- a **regional and/or ethnic and/or religious and/or linguistic affiliation level**, as most nations are composed of culturally different regions and/ or ethnic and/or religious and/or language groups;
- a **gender level**, according to whether a person was born as a girl or as a boy;
- a **generation level**, which separates grandparents from parents from children;
- a **social class level**, associated with educational opportunities and with a person's occupation or profession;
- for those who are employed, an **organizational or corporate level** according to the way employees have been socialized by their work organization. (ibid. 18.)

In his studies Hofstede focused on defining the national culture differences by collecting survey data about the values of people in over 50 countries around the world. A statistical analysis of the answers on questions about the values of IBM employees in different countries revealed common problems, but with solutions differing from country to country, in the following areas:

1. Social inequality, including the relationship with authority;
2. The relationship between the individual and the group;
3. Concepts of masculinity and femininity: the social implications of having been born as a boy or a girl;
4. Ways of dealing with uncertainty, relating to the control of aggression and the expression of emotions.

Based on these results, the researcher distinguished **four major dimensions of cultures**:

1) **Power distance**
   It is defined as the extent to which the less powerful members of organizations within a country accept that power is distributed unequally.
2) **Collectivism versus individualism**
   It refers to the degree of interdependence a society maintains among its members.
3) **Femininity versus masculinity**
   The fundamental issue is what motivates people, wanting to be the best (masculine) or liking what they do (feminine).
4) **Uncertainty avoidance**
   It measures the extent to which the members of a culture feel threatened by uncertain situations. (ibid. 29-31.)

Besides those major cultural characteristics there are also ***long term orientation*** (linking past experience to deal with the challenges of the present and future) and ***indulgence*** (the extent to which people try to control their desires and impulses) defined by the sociologist later in his research (Hofstede 2017).

Based on interviews of IBM employees with different backgrounds, Hofstede rated each of 50 countries under study from small to large according to the level characterized by these dimensions. These figures are to be utilized for analysing the concern about safety regulations in Russian and Finnish societies. The most relevant

dimensions to this topic are ***uncertainty avoidance*** (how important is a law establishment is considered in the country for avoiding ambiguous circumstances) the ***power distance*** (the role of authorities in ensuring the compliance with safety rules) and ***collectivism vs individualism*** (the role of general public perception and the example of group members behaviour in terms of complying with safety regulations). The reader will get to know about those in more details in the analytical part of the thesis.

3.3 Occupational health and safety (OHS)

This chapter is aimed to describe the term of occupational safety more in details. In general, it can be defined as *the health and well being of people employed in a work environment*. Statistically, there are more than 250 million work-related accidents every year. Workplace hazards and exposures cause over 160 million workers to fall ill annually, while it has been estimated that more than 1.2 million workers die as a result of occupational accidents and diseases. Social and economic costs are unacceptable; therefore, continuous progress in protecting health and safety is a priority objective for International Labour Organization (ILO). (Benjamin 2001.)

The roots of OSH can be found at the time of the Industrial Revolution in the early 1800s. Factories and their new technologies, complex machines and production methods quickly spread throughout the continent. New skills were needed to operate the new machines and factories, but working conditions did not progress at the same pace. Occupational risks became more serious and difficult to prevent, leading to accidents, disabilities and fatalities at work. It emerged the need to be protected from industrial hazards and risks. The first modern legislation on health and safety came into force in Britain and Norway almost at the same period. However, legislation was not the only way of securing OSH – key public institutions contributing to its development, such as labour inspectorates, were also created. (Castillo 2016.)

In 1978, the Council of the European Union passed a resolution on the first Action Programme on Safety and Health at Work in the EU (Council of the European

Communities 1978). The aim of the programme was to increase the level of protection against occupational risks of all types; it aimed to do this by increasing preventive measures as well as by the monitoring and controlling of risks. The EU legislative structure was supported by various building blocks such as the European Agency for Safety and Health at Work (EUOSHA) and the Advisory Committee on Safety and Health at Work. (Castillo 2016.) Nonetheless, new directives and social policies needed to be implemented in order to achieve European harmonization in health and safety. Therefore, in the mid-2000s, the European Commission adopted 'Better Regulation' as a key strategy. Better Regulation – an approach born in the United States and then adopted by the Organisation for Economic Co-operation and Development (OECD 1995) – focuses on simplifying legislative actions. Updating directives and their content, the European Commission focused mainly on competitiveness and innovation.

In 2014 a new Strategic Framework was announced for the period 2014-2020. It contains three major challenges: 'improving the implementation record of Member States, in particular by enhancing the capacity of micro and small enterprises to put in place effective and efficient risk prevention measures; improving the prevention of work related diseases by tackling existing, new and emerging risks; tackling demographic change' (European Commission 2014a).

It is worth noting that there are significant variations in occupational health and safety performance between:

- Different countries (for example, a factory worker in Pakistan is eight times more likely to be killed at work than a factory worker in France);
- Economic sectors (agriculture, forestry, mining and construction take the lead in the incidence of occupational deaths worldwide);
- Sizes of enterprise (small workplaces have a worse safety record than large ones).

Moreover, there are groups of employees who are particularly at risk such as

- Female workers (safety standards are based on the model of a male worker);
- Home-based workers (in some countries they are subjected to normal health and safety legislation, in others not);
- Part-time workers (suffer from not being covered by health and safety provisions); contract workers (accident rate is on average twice that of permanent workers);
- Drivers (between 15 and 20 per cent of fatalities caused by road accidents are suffered by people in the course of their work).

International Labour Organization utilizes a range of actions to promote occupational health and safety including international labour standards, codes of practice, the provision of technical advice and the dissemination of information. Occupational health and safety standards broadly fall into six groups, according to their scope or purpose:

- Fundamental principles to guide policies for action;
- General protection measures, for example, guarding of machinery, medical examination of young workers, or limiting the weight of loads to be transported by a single worker;
- Protection in specific branches of economic activity, such as mining, the building industry, commerce and dock work;
- Protection of specific professions (for example, nurses and seafarers) and categories of workers having particular occupational health needs (such as women or young workers);
- Protection against specific risks (ionizing radiation, benzene, asbestos); prevention of occupational cancer; control of air pollution, noise and vibration in the working environment; and measures to ensure safety in the use of chemicals, including the prevention of major industrial accidents;
- Organizational measures and procedures relating, for example, to labour inspection or compensation for occupational injuries and diseases.

In general, the ILO policy on occupational health and safety is essentially contained in two international labour Conventions and their accompanying Recommendations:

1. ILO Occupational Safety and Health Convention (No. 155), and Recommendation (No. 164), 1981, which provide for the adoption of a national occupational safety and health policy, as well as describing the actions to be taken by governments and within enterprises to promote occupational safety and health and improve the working environment;
2. ILO Occupational Health Services Convention (No. 161), and Recommendation (No. 171), 1985, which provide for the establishment of enterprise-level occupational health services designed to contribute towards implementing occupational safety and health policy.

Based on the content of ILO regulations several core occupational and health principles are to be defined:

I. *All workers have rights*. As the International Labour Conference stated in 1984:
   a. work should take place in a safe and healthy working environment;
   b. conditions of work should be consistent with worker well-being and human dignity;
   c. work should offer real possibilities for personal achievement, self-fulfilment and service to society.

II. Occupational health and safety policies must be established

III. There is need for consultation with the social partners (that is, employers and workers) and other stakeholders

IV. *Prevention and protection must be the aim of occupational health and safety programmes and policies*. Workplaces and working environments should be planned and designed to be safe and healthy.

V. Information is vital for the development and implementation of effective programmes and policies. The collection of accurate information on hazards, monitoring of compliance with policies and good practices, and other related

activities are central to the establishment and enforcement of effective policies.

VI. *Health promotion is a central element of occupational health practice.*

VII. *Occupational health services covering all workers should be established.*

VIII. *Compensation, rehabilitation and curative services must be made available to workers who suffer occupational injuries, accidents and work-related diseases.*

IX. *Education and training are vital components of safe, healthy working environments.* Workers and employers must be made aware of the importance and the means of establishing safe working procedures. (Benjamin 2001.)

According to ILO Newsroom, Finland joined ILO occupational health and safety programme in 2014. During the conference on this occasion taking place in Helsinki Finnish Minister of Social Affairs and Health, Laura Räty said: "With Finnish occupational health and safety know-how we want to improve the working conditions of target countries by promoting work that is fit for humans”.

The programme was supposed to provide policy and strategy advice to governments, employers and workers in low and middle-income countries where OSH systems need to be strengthened. (Finland joins ILO occupational safety and health programme 2014.) Most of new Finnish OSH legislation is prepared in the bodies of the European Union at the initiative of the European Commission. Finnish experts take an active part in the preparation of EU OSH legislation. Finland’s aim is to achieve a modern, effective, fact-based and evidence-based body of Community law in this area. This approach has already brought some positive results. Finland is slightly below the EU average in the incidence of severe and fatal occupational accidents, and is pursuing a determined zero-accident policy, aiming to become a world leader in OSH promotion. (Ministry of Social Affairs and Health 2010.)

European Union statistical data platform, Eurostat, provides information about fatal accidents at work in EU countries. Figure 11 represents a comparison of EU average

incidence rate in warehousing and support activities for transportation with rates in fourteen EU countries for the period of 2012-2014. It shows that Finland, having generally low incidence rate in logistics sector – around average of all EU countries, managed to reach zero level in 2013 and 2014.

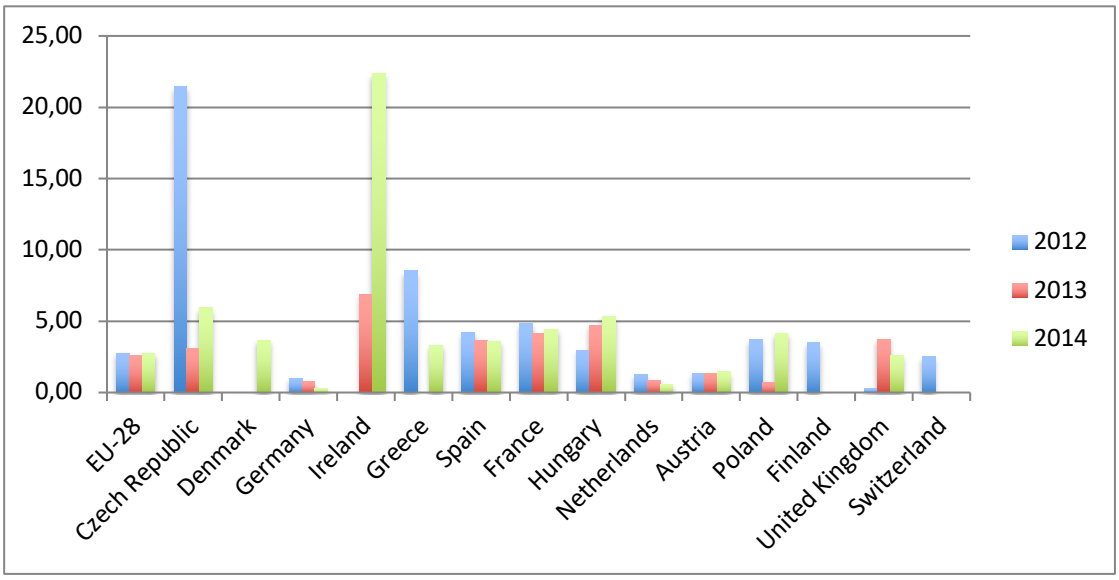

Figure 11. Fatal accidents at work in EU countries 2012-2014 (adapted from Eurostat 2017)

3.4 Costs of incident

First of all, damage to human health and life is itself a serious negative consequence of accidents caused by violations or improper safety management. From company's operation point of view it is crucial to understand that every single incident leads to significant money loss. For instance, in a transport company studied by the Health and Safety Executive, the costs of accidents were equivalent to one third of its annual profits. (Health and Safety Commission 1999) Organizations incur both direct and indirect costs from workplace accidents and injuries: direct costs include payments to injured workers and costs of their treatment, and cost of health and accident insurance; indirect costs include lost productivity and overtime charges (Clarke 2016, 12). They are represented by traditional iceberg concept: direct as an iceberg visible part above the water - accrued directly from the accident and indirect as an iceberg part submerged in the water - less obvious consequences of the accident. Although

the indirect ones are normally more difficult to define since most of them are hidden, they usually have greater impact on company's profits and sales. In order to estimate an overall financial influence of incidents, we should be able to calculate both. Direct cost is the total value of insurance claims for an incident consisting of medical costs and indemnity payments. Indirect cost is a multiplication of the direct cost by a cost multiplier. The bigger the direct cost, the smaller the cost multiplier. This kind of costs may refer to a replacement employee, repair damaged property or equipment, downtime of equipment, investigating the incident and implementing corrective actions. Even less apparent are the costs related to product schedule delays, added administrative time, lower morale, increased absenteeism, pain of the employee and impaired customer relations. In the book subtitled *Practical Loss Control Leadership* the same analogy of iceberg theory was used to describe accident costs. While the visible tip of the iceberg accounts 1 $, from 5 $ to 50 $ is likely to be spent on below the surface adding from 1 $ to 3 $ of bottom costs. (Roughton 2002, 7-10.)

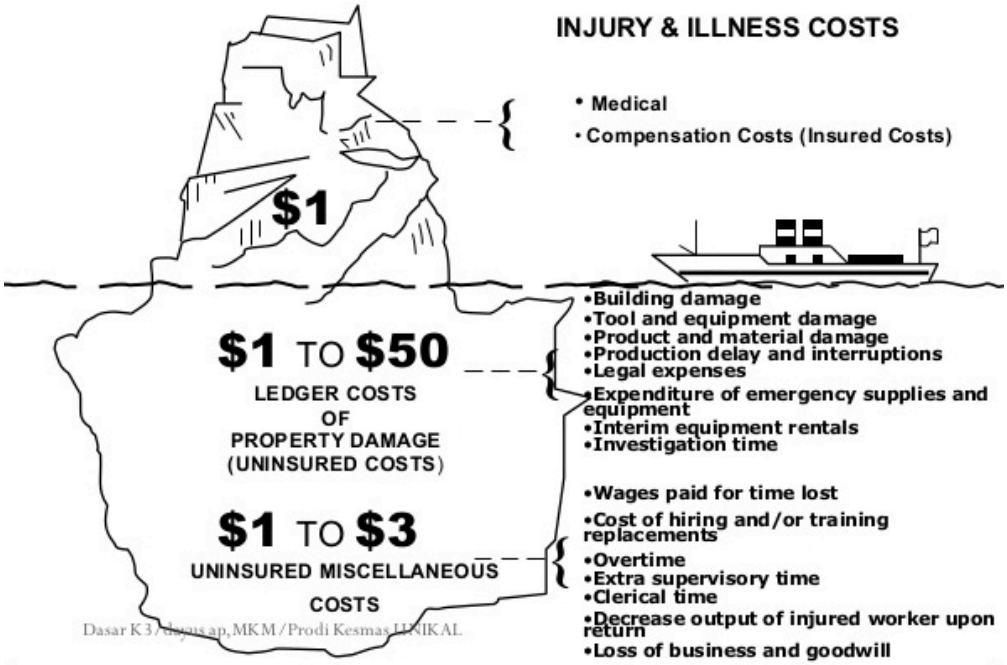

Figure 12. The cost of incidents at work: ILCI cost studies (adapted from Roughton 2002)

In Figure 12 it is illustrated that the actual cost of workday injury is much greater than it seems to be from the surface. Indirect and hidden costs might cause much more significant financial and operational damage, they include:

- Productive time lost by injured employee
- Productive time lost by employees and supervisors attending the victim
- Clean-up and start-up of operations interrupted by the incident
- Time to hire and retrain other individuals to replace the injured employee until their return to work
- Time and cost for repair or replacement of damaged equipment or materials
- The cost of losing a valued customer due to poor performance or late delivery of goods and services
- Poor or eroded morale among employees
- Lower efficiency
- Increase workers' compensation EMR rates
- Possible penalties or other sanctions applied where the injury is determined to be caused by a violation of regulations
- The cost of completing the paperwork generated by the incident

Therefore, these days companies aim to establish an efficient safety management in order to reduce the costs and risks associated with incidents. (ibid., 12-13)

In general, there are a number of steps that can be taken to reduce the chance of accidents and ill health happening in the business:

1. Determine what could cause harm
2. Identify who might be harmed (employees, visitors and others)
3. Decide what should be done to prevent anything happening to them
4. Take action in a planned way recording what have been done
5. Check these actions are still working from time to time (Health and Safety Commission 1999)

This list of steps is a simple guidance to safety engineers who have to accomplish a great work in order to realize preventative actions and manage the risks in the most effective way.

3.5 Safety management system evaluation

Safety relates directly to the quality of the production/service process inside an organization. Therefore, all safety management systems function within and support company's operations system. Safety manager has an overall responsibility for the SMS, but primarily focuses on the physical safety and health of employees through the use of administrative controls to limit exposure to hazards. Whereas the safety engineer, who usually works in the maintenance or engineering department, is interested in using engineering controls to eliminate or reduce hazards. HR coordinator´s duty in terms of safety is to assure the quality of safety programs and affect the psychological health of employees. All these people are in charge of creating a structured and reliable SMS that can be supported by all the other employees. (OSH Academy 2017, 3-5.) Each safety management system consists of three main components defining its nature:

- Inputs
    - Standards
    - People
    - Resources
- Process
    - Procedures
    - Consequences
- Outputs
    - Products and services
    - Conditions
    - Behaviours (Roughton 2002, 349)

After developing and implementing management system, it's important to test and evaluate it in order to understand whether it works effectively. There are many tools that can be used to evaluate any workplace: independent review, employee safety perception survey, document (records) review, workplace evaluations, self-assessments, job hazard analysis, employee interviews, etc. However, it is worth focusing on the three of them:

- **Reviewing documentation** of specific activities (safety committees, business contracts, activity-based safety system and etc.);
- **Interviewing employees** in the organization for their knowledge, awareness, and perceptions of what has happen to the management system and the safety program;
- **Reviewing site conditions** and finding the opportunities for improvement in the management systems in case hazards are present. (ibid. 353)

The key to a successful and efficient assessment and program evaluation is to combine elements when using each technique. First, review the available documentation relating to each element. Then walk through the workplace and observe how effectively what is on paper is implemented, in other words, verify compliance with the written documents. While walking around the facility, interview employees to confirm that what was read and what was seen reflects the state of the safety program. (ibid. 376.)

These days there is a number of European standardisation organizations developing norms applied to the different aspects of company business such as product or service quality, environmental friendliness as well as health and safety at work. European Committee for Standardization (CEN), European Committee for Electro Technical Standardization (CENELEC) and European Telecommunications Standards Institute (ETSI) — set and update European standards on a regular basis. The companies are evaluated and certified in case their activities meet the essential requirements. In Finland the central body for standardisation is the Finnish Standards Association (SFS). There is also The Centre for Occupational Safety aims to improve

occupational safety, wellbeing at work, effectiveness, the work of supervisors and cooperation in workplace communities. It is administrating a Finnish National Occupational Safety Card that has rapidly become a popular way to complete the basic training in safety and health at work (The Occupational Safety Card 2007, 3). The UPM General Instructions state that *all the supplier's employees shall have a valid occupational safety card* which is given upon completion of UPM Safety orientation e-learning course. It is mandatory for every employee who does physical work at a UPM production site, however, excluding drivers of heavy vehicles.

Moreover, there is internationally applied British Standard for occupational health and safety management systems (OHSAS 18001) which is aimed to help all kinds of organization to identify and control health and safety risks, reduce the potential for accidents, aid legal compliance and improve their overall performance. (European Agency for Safety and Health at Work [Safety and health legislation], 2017) It is essential to note that according to UPM certification overview by April 2017 UPM Kaipola has already put OHSAS system in place, however, has not been certified yet. (UPM certification overview – status April 2017.) This fact directly testifies that safety management system at the plant still needs to be developed and improved in order to meet European standards.

4 Risk evaluation and control

4.1 Concept of risk

The concept of risk has various definitions in literature. However, it can be generally constructed by two elements: probability of loss and significance of loss. Normally, risk is associated with negative effect, which can be expressed in terms of a threat, damage, loss, injury or other undesirable consequences. ***Risk*** is the chance high or low of being harmed by the hazard, and how serious harm could be. (Rocle 2014, 1.) It is very important to distinguish between a hazard and a risk – the two terms are often confused and activities often called high risk are in fact high hazard. Electricity is an example of a high hazard as it has a potential to kill a person. The risk associated with

electricity – the likelihood of being killed on coming into contact with an electrical device. (Hughes & Ferret 2015.) Mathematically it can be calculated in the following way: **RISK = LIKELIHOOD X SEVERITY.** Quite often this formula also includes exposure factor.

Risks occur because of uncertainty about the future that may lead to the unexpected events typically causing some kind of damage (Waters 2011, 14).

4.2 Risks in supply chain

In the previous paragraph the general concept of risk management was explained in details. However, it is also worth taking a deeper look at how this process goes particularly in logistics. Supply chain risk management is the process of systematically identifying, analysing and dealing with risks to supply chain. In terms of risk management, logistics has two roles:

1. A strategic role of designing supply chains that are resilient and can withstand risky events
2. An operational role of reacting to events that actually occur and mitigating the effects

To achieve this, logistics brings together a series of functions that are responsible for different aspects of the movement of materials. Apart from its core activities related to the flow of materials such as supply chain design, purchasing, inbound transport, receiving, warehousing, stock control, material handling, order picking, outbound transport, physical distribution, recycling, returns and waste disposal, there is also one more important function - communication which coordinates the flow of information. This case study mostly focuses on this particular function. Quite often the reason for disruptions in a supply chain is insufficient exchange of information.

Specifically, risks to the supply chain are unforeseen events that might interrupt the smooth flow of materials. (Waters 2011, 43-44.) There are basically two kinds of risks to a supply chain:

1) ***Internal risks*** that appear in normal operations, such as late deliveries, excess stock, poor forecasts, financial risks, minor accidents, human error, faults in information technology systems
2) ***External risks*** that come from outside the supply chain such as natural disasters, wars, crime, industrial action, price rises, shortage of raw materials, financial irregularities

Even a relatively minor problem with a supply chain can have broad consequences – in a way that a late delivery of raw materials can affect operations resulting into decrease in company's basic performance measures and impairment of its reputation. Therefore, the company should constantly work on eliminating or at least mitigating the risks. The best approach to supply chain risk management has each member of a chain working together in a coordinated effort to reduce the overall vulnerability of the whole supply chain. However, there are many factors preventing integration of supply chain risk management. There are two of them that needs to be pointed out: the first one is limited contact between members of supply chains and the second one is a problem with information sharing, as a result, no relevant information available at all points in the supply chain – poor visibility.

4.3 Risk management and assessment

Risk management is adopted at company-level and aims at ensuring a company's survival, future success and at minimizing risk-related costs. In general, there are two different approaches to risk management: reactive and proactive. The first one is used when an unforeseen event actually occurs, however, it might be too slow so that plenty of harm can be done before it begins to have an effect. The more effective approach to risk management is proactive based on analysing likely events before they occur and planning steps to mitigate their effect. These days managers tend to implement the second principle. Three core elements of risk management can be distinguished:

1. **Identify risks**

   Output: a list of risks facing the operational process

2. **Analyse the risks**

   Output: prioritized list of risks and their expected consequences

3. **Design appropriate responses to the risk**

   Output: planned response to each risk – prevention (reduce the probability), mitigation (reduce the consequences) or rather response (first evaluate actual events then act)

The UPM Group risk management process gives broader insight. It involves regular monitoring and evolving approach and includes the following phases:

1. Risk identification and assessment
2. Development of risk management strategies
3. Design and implementation of risk management procedures
4. Monitoring of risk management performance
5. Continuous improvement of risk management capabilities. (Huovinen 2009.)

Risk assessment is an integral part of a risk management plan. It is a process of evaluating risks arising from hazards, taking into account any existing controls, and deciding whether or not risks are acceptable (reduced to a level that can be tolerated). It is more effective to accomplish this kind of task at the actual worksite with an input of operators. There are two types of risk assessment: *simple* (used to confirm the controls of an existing risk assessment) and *formal* (used to manage risks associated with projects, tasks and activities through identification of hazards and controls). (Rocle 2014, 4.)

Risk assessment is a fundamental requirement for business and should consider everyone who could be affected by the activity. Besides employees this includes contractors, temporary workers, volunteers and the general public. The aim should always be to reduce the risks as much as is “reasonably practicable”. It means that

employers have to balance the cost of steps that they could take to lower a risk against the degree of risk presented.

Risk assessment is an essential part of occupational safety and regulated by law. The Management of Health and Safety at Work (MHSW) Regulations 1999 require all employers and the self-employed to assess the risks from their work on anyone who may be affected by their activities. The Regulations require employers to execute a systematic examination of their work activities and record the significant findings of the assessment. If an employer has five or more employees, the findings must be recorded in writing. (Risk assessment 2017.)

There is a number of tools and techniques used for risk assessment. One of the most common qualitative methods of assessing risks is ***probability and impact matrix***. It is typically created for determining the probability and significance of a risk of an unwanted event. (Dumbravă & Vlăduț 2013, 87.) The matrix may be customized according to the needs of the project but it usually covers five main aspects: health and safety, environment, security, process safety and product safety (Rocle 2014, 1). Risk calculation is very simple considering that likelihood and impact of an event is assigned a random basis to the total that can be a particular classification (Dumbravă & Vlăduț 2013, 87). Those two parameters are scored numbers from one to five according to the degree level. (See Table 1)

Table 1. Simplified model of the probability and impact classification (adapted from UPM Madison, 2015)

Score	Likelihood of the event	Score	Severity of the impact
1	very unlikely	**5**	severe
2	unlikely	**4**	major
3	possible	**3**	medium
4	likely	**2**	minor
5	very likely	**1**	not significant

After awarding all the scores defined by the operators, two variables are to be multiplied. (Dumbravă & Vlăduț 2013, 87-88.) Based on the result, the risks are rated and classified from very low to very high. The classic example of the matrix is represented in Figure 13 where using collation of probability of the event and the degree of its potential consequences the assessor is able to define its risk level. For instance, *likely* event, which is expected to occur at some time with a *not significant impact* such as minor injuries or discomfort of the worker, has a *medium risk level* represented by yellow colour in the table. Green, orange and red colours refer to the low, high and very high risk levels respectively.

			Potential Consequences				
			L6	L5	L4	L3	L2
			Minor injuries or discomfort. No medical treatment or measureable physical effects.	Injuries or illness requiring medical treatment. Temporary impairment.	Injuries or illness requiring hospital admission.	Injury or illness resulting in permanent impairment.	Fatality
			Not Significant	**Minor**	**Moderate**	**Major**	**Severe**
Likelihood	Expected to occur regularly under normal circumstances	**Almost Certain**	**Medium**	**High**	**Very High**	**Very High**	**Very High**
	Expected to occur at some time	**Likely**	**Medium**	**High**	**High**	**Very High**	**Very High**
	May occur at some time	**Possible**	**Low**	**Medium**	**High**	**High**	**Very High**
	Not likely to occur in normal circumstances	**Unlikely**	**Low**	**Low**	**Medium**	**Medium**	**High**
	Could happen, but probably never will	**Rare**	**Low**	**Low**	**Low**	**Low**	**Medium**

Figure 13. Risk matrix template (Examspm 2016)

The example of using risk matrix is illustrated in *Radiation Risk Assessment using Unsealed Radionuclides* (see Table 2). If the likelihood score is thought to be three and the consequence score is four (from whole body dose calculations), then the risk rating is equal to twelve (three multiplied by four).

Table 2. Risk matrix example (Radiation Risk Assessment 2008)

CONSEQUENCE	LIKELIHOOD				
	Rare (1)	Unlikely (2)	Possible (3)	Likely (4)	Almost certain (5)
Catastrophic (5)	5	10	15	20	25
Major (4)	4	8	12	16	20
Moderate (3)	3	6	9	12	15
Minor (2)	2	4	6	8	10
Negligible (1)	1	2	3	4	5

The risk rating (1-25) from Table 2 corresponds to a risk score (1-4) as given:

1. Very low
2. Low
3. Moderate
4. High

Accordingly, with the risk rating being twelve, the risk score is four referring to a high level of risk. That great risk is usually associated with disastrous effect. (Guidance on completing a Radiation Risk Assessment using Unsealed Radionuclides 2008.)

In order to prevent fatal effect of risks, they have to be defined, assessed and managed beforehand. All those procedures are to be planned by company's managers.

5 Research and analysis

5.1 Research plan

The research was conducted during a period of three months from the 15th of May to the 15th of August 2017.

During this time the researcher had to study the UPM safety directives and instructions applied to the truck drivers (See Figure 14)

Figure 14. UPM Safety directives and instructions under study

The plan was to determine whether all the official rules were reflected in the actual instructions provided for the drivers.

Besides content analysis, non-participant observation of how the arriving trucks operated was executed from the time they reached the mill site till the truck was unloaded. By using this method the observer could form a clear picture of how the drivers performed their work in the stage of the unloading process and capture the risky moments and violations with the help of a camera. The observations were conducted in May-August in the form of regular visits to the RCP warehouse once or twice a week between 8 am and 4 pm. The sequence of the drivers' working process and bottleneck steps (where the drivers faced difficulties to perform their work and where safety risks arose) were represented with the help of a flowchart. The plan was also to report the carrier name, date of observation and tick the observed violations in the form of check sheets. After collecting the total number of each violation per each month, the observer could analyse the trend by using a run chart tool by connecting the changes with the performed arrangements.

Moreover, in order to define the risk level of the hazards that the drivers faced if they behaved contrary to the safety rules established in UPM and in order to understand which of them were the most critical ones, the author had to do ***risk assessments*** specifically for the drivers' working areas including both the RCP and chemical pulp unloading stations. Due to the fact the author of the thesis had never done this before, she asked for help from the operators and managers who gave a template that they used for these kinds of analysis. The template consisted of several columns:

- Subject/event
- Hazard
- Description of hazard
- Possible consequences
- Likelihood of occurrence
- Current arrangements
- Risk level
- Future corrective arrangements

To make the evaluation easier, the assessor divided the hazards, possible consequences, likelihood of occurrence and risk level into several categories.

Figure 15 shows six types of the main hazards that the drivers can be exposed to while working at the mill site: moving vehicle (wheel loader or truck), traffic (any barrier to the necessary movement of the vehicle), falling object (unstable pile), protruding object (nail or beam), dust or external particles (metal or paper chips) and visibility impairment (steam or objects blocking the view).

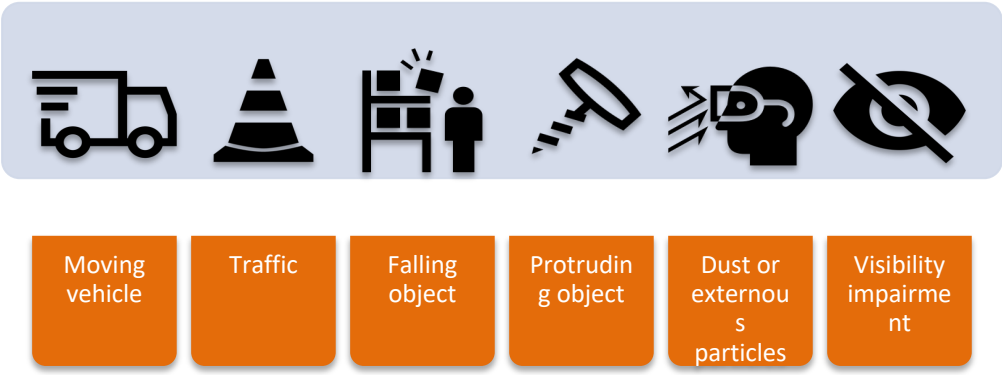

Figure 15. Hazard classification (adapted from RCP warehouse risk assessment template)

The exposure to those hazards can lead to four major consequences illustrated in Figure 16, such as serious health effects or fatalities, health injuries (bruise or sprain), property damage (truck construction damage) and operational disruption (delivery delay).

Figure 16. Effects (adapted from RCP warehouse risk assessment template)

Depending on the degree of possible consequences, they can be scored from one to five (from “not significant” to “severe”). As obviously the life and well-being of the employees is prior in consideration, serious impacts on their health or deaths are rated by the highest score. Such effects as property damage and operational disruptions might vary from one to four by their severity defined by the operators.

All the hazardous events have different likelihood of occurrence so that each of them can be classified accordingly to probability levels from “rare” to “almost certain” (scored from one to five respectively). Based on the hazard category, its effect and probability of occurrence, the risk level can be defined from low to very high. Those were previously described in the risk matrix template. (See Figure 9, chapter 4.3)

Semi-structured reflective interviews with the Russian-speaking drivers and transportation companies were supposed to be the most effective way to create a temporary communication bridge between UPM and the contract carriers. Due to the lack of common language, it is challenging to understand the reasons for different behaviour and cooperate in work. The answers to the open questions should also illustrate the general attitude of the drivers towards complying with the rules. The drivers were interviewed while the unloading was carried out or when they were waiting outside the warehouse. There were 16 questions (see Appendix 3), but the number varied depending on their answers. The main topics covered in the interview are represented in Table 3. It divides all the questions into eight categories and describes the reasons why particular types of question needed to be asked.

Table 3. Interview's topics

QUESTION CATEGORY	PURPOSE
Carrier information	To know whose employees tend to violate the rules more often
Driver's experience	To understand how the frequency of the violations is dependent both on driver's experience in general and at particular mill
Instruction method in terms of OSH	To see the difference with methods used at UPM
Familiarization with UPM safety rules	To know if the memos with UPM rules reach the drivers
Working process	To see how and in which order the driver completes each stage of his work
Communication with UPM operators	To defines if there is a problem of language barrier
Difficulties in work	To see the hidden reasons for violations
Suggestions for improvements	To get an idea of the arrangements that should be done to improve the situation

The idea was to visit the warehouse for general observations and selectively ask some of the drivers to participate in the interview. It was very important to ascertain that the drivers did not know that they were supposed to be interviewed. In this way, it could be expected that they would reply to the questions naturally and that there was a bigger chance that the information was veritable.

5.2 Research process

This chapter is aimed to describe the process of data collection by the researcher. The author of the thesis started the research with going through the safety directives established and documented in UPM in order to execute content analysis and distinguish the ones that are specifically applied to the drivers. First of all, the researcher tried to define to which category of the employees those drivers actually belong. There were two types of external workers mentioned in the rules: visitors and contractors. However, after looking at their definitions one made a conclusion that the driver does not belong to any of this group. ***Visitor*** is a person not part of site personnel, not working permanently on site and has a host all times such as UPM employee from other work places, clients, authorities, officials, university students and others. ***Contractor*** is a specific type of supplier that executes physical work for UPM on site such as cleaning personnel, catering staff, logistics operators, maintenance and others. Drivers are not working permanently on site but they do perform physical work included in their duties even though they do not directly participate in the unloading process. Nevertheless, they still must adhere to *UPM General Safety Rules* and partly safety rules for contractors that are summarized in the following list:

- Being in the mill area under the influence of **alcohol or drugs**
- **Photography** is not allowed in the UPM mill areas
- **Smoking** is not allowed at any UPM sites in Finland
- **Eating** in the mill area is only allowed in designated areas
- UPM will provide the suppliers with all the necessary **maps** when moving in the mill area
- All persons arriving in the mill area must **check-in** at the main gate
  This rule is not applied to the drivers since they obtain special permit to enter directly through the mill gates
- UPM's rules regarding mobility and **vehicle pass** practices must be followed when transporting goods to or from a worksite

- The vehicle pass must be placed so that all **identification information** is fully visible from outside the vehicle
- **Sleeping** in caravans or mobile homes inside the mill area or in any car parks is not allowed
- Any **discrimination, harassment or bullying** or any other inappropriate behaviour must be addressed without delay
- No goods may be stored in front of access routes, emergency exit routes, emergency showers, switch boxes, switchboards or fire extinguishing equipment
- UPM requires that the drivers work in such a manner that generates **as little waste as possible**
- Drivers must work in such a manner that **no confidential data** or materials end up in the possession of third parties

- Contractors' employees are required to wear **personal protective equipment** (PPE) at UPM's premises. **Any employee who does not use the required PPE may be removed from the worksite!**

Afterwards the author of the thesis studied *Safety instructions for the drivers delivering recycled paper to UPM Kaipola* and *Safety guideline for Russian-speaking drivers* that were sent to UPM Russia in 2012 and were supposed to be distributed through all the partner transportation companies in order to define whether they were relevant. The warehouse operators were asked what were the most common issues in drivers' behaviour.

After contacting one of Finnish carriers – VR Transpoint, the researcher also received *Safety requirements for heavy traffic UPM Finland production plants* they used as the instructions for their drivers. The only version available is in Finnish language and all the drivers in this company send are Finnish-speaking.

One of the selected research methods was interviewing the drivers with previously described questions aimed to reveal the actual reasons for violations. It is important

to note that it was difficult to organize the drivers coming at specific day and time since for recycled paper trucks it really depended on how smooth the process went at customs border, quite often the deliveries were postponed until late evening. Moreover, during summer time the production does not work at a full capacity meaning it required less raw materials so there was limited amount of trucks coming each week. For chemical pulp most of the drivers were coming during evenings and nights.

Therefore, as a result, at RCP warehouse the researcher managed to conduct 16 interviews including drivers from five transportation companies: NBI Transport Service, Logistics Service, IP Shestakov V.V., Premium Transport and IP Sergeev. (See Figure 17) Most of them were representing the key carrier – NBI Transport Service.

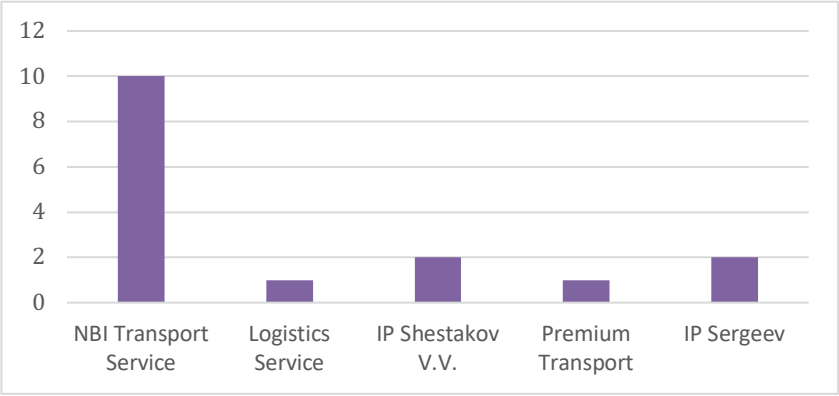

Figure 17. Number of interviewed drivers per carrier

Along with the interviews the author of the thesis was also observing how the unloading process went in general and reporting about the violations were noticed. For the whole period from May to July the trainee has conducted 16 observations at RCP warehouse and seven at chemical pulp station that proved that every single unloading of Russian truck is accompanying with at least one minor offense.

5.3 Analytical process

As a result of safety documents studies, it turned out that the instructions supposedly provided to Russian-speaking drivers were obsolete so that many

important aspects included in the UPM's general instructions since 2012 were missing, therefore, they needed to be updated. *Safety requirements for heavy traffic UPM Finland production plants* used by VR Transpoint contained more complete set of safety rules. According to this document, all drivers must have and use all the necessary PPE (minimum requirement: helmet, goggles, high-visibility vest and safety shoes) in the factory area; they must comply with the specified loading/unloading policy and undergo safety training (valid for two years) before they first arrive at the factory area inform UPM staff of any detected safety deficiencies (however, online training – safety induction is available only in Finnish, Swedish, English, German, French and Chinese, not in Russian); all Finnish drivers must have a valid Safety Card; and since January 1, 2013 smoking is forbidden in the whole factory area.

However, this guideline was available only in Finnish language, therefore, it could be applied only to Finnish-speaking drivers. Moreover, there were some specific verbal rules related to the unloading process that must have been followed by the driver but they were not documented anywhere, for instance:

- It is FORBIDDEN walk/drive inside the RCP warehouse without special permission;
- It is FORBIDDEN to move around the mill site in the unauthorized places;
- While the unloading process the driver must keep away from the wheel loader with the considerable distance;
- It is FORBIDDEN to stay in the truck body while the unloading process;
- It is MANDATORY to put wheel blades under the wheels if the forklift drive inside the truck for unloading.

Basically, there was no document including all the safety rules to be followed by the drivers and insufficient guidance about overall working procedure of the driver at UPM Kaipola mill. Furthermore, most of the relevant information is provided in Finnish or rather English language.

The first analysing tool, flowchart, helped to study the entire working process of the truck driver at UPM Kaipola and define the stages at which one faced the problems thereby increasing safety risks. Appendix 4 shows which steps a driver delivering RCP had to undergo from the moment he arrived till the moment he left. Red crosses show critical steps when communication and safety issues most likely to occur. For example, in case a driver came to UPM Kaipola for the first time, he was not provided with specific instructions, therefore, the driver had to leave the truck and go to the main entrance so that security guard could provide him with a map of the mill site and describe how to reach the RCP warehouse. Not having a prior guideline and language barrier causes misunderstanding and further violations by truck drivers.

With a help of check sheets filled during observations each month, it was revealed that the most common violations were related to the absence of the required personal protective equipment (at least one item was missing) and standing close to or inside the truck body while the unloading process. Table 4 is the example of the check sheet for the first month (May 2017) of the observations. The analyst used it to mark with the cross noticed violations and recap the number of them hence, for instance, in two out of four checks the driver stayed close to the truck body while unloading.

Table 4. Check sheet. May 2017

Company Date ***Violation***	Logistic Service 24.05.17	NBI Transport 29.05.17	NBI Transport 30.05.17	Premium Transport 30.05.17	***Total number***
No goggles	x	x		x	***3***
No helmet	x	x			***2***
No HV vest	x				***1***
No shoes	x			x	***2***
Inside truck body				x	***1***
Close to truck body	x			x	***2***

Table 5 represents the statistical summary of all check sheets (observations). It shows what kind of and how many times violations were noticed as well as some of the possible risks for each of them.

Table 5. Violation statistic

Violation	Frequency	Risk
no goggles	11	dust particles or metal/paper chips get into eyes
no helmet	2	falling or protruding object (pile/supporting beam)
no HV vest	1	struck by the wheel loader
no shoes	6	heavy/sharp obstacle, wheel loader run over feet
inside truck body	6	struck by the wheel loader
close to truck body	7	struck by the wheel loader

The most frequently noticed violation was not wearing goggles. Eleven out of sixteen drivers did not follow this requirement even though it is very important to have goggles on. The warehouse is considered a dusty area full of metal and paper chips; those particles can seriously harm human eyes.

In order to illustrate the evidence of those violations the thesis trainee was also taking photos and videos of on-going operations. Figure 18 shows one of such violations when the driver stayed dangerously close to the wheel loader while the truck was being unloaded.

Figure 18. Example of violation

In order to see the trend of violation frequency over time the analyst used run chart tool (see Figure 19). According to the chart, the blue line showing the number of drivers violating safety rules per month tends to descend. The number of checks per month remained constant – red line of the chart. Critical event happened in the middle of June 2017 marked on the graph with a star is the day when it was officially stated by the director of UPM Kaipola, Marko Laakkonen: Truck is not unloaded till the driver has all the required personal protective equipment (PPE) on.

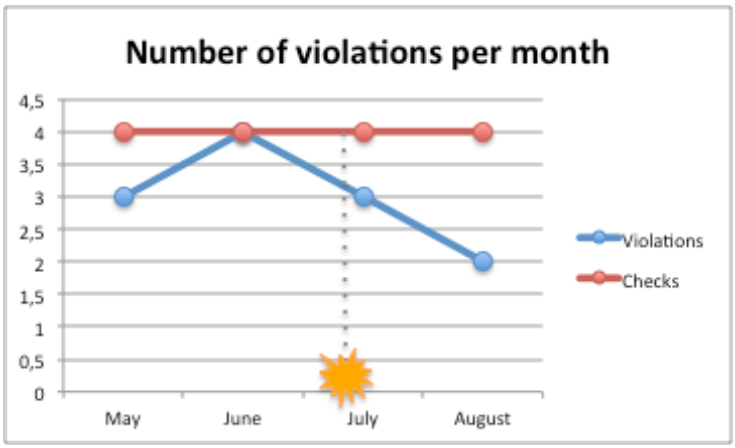

Figure 19. Checks vs Violations per month

In the beginning of August 2017 some minor improvements such as updating of the mill maps and safety signs were done. These actions also supposedly influenced the trend.

As a result of risk assessment procedure conducted during the observations, the assessor evaluated risk levels for 15 hazardous events occurring in RCP warehouse and eleven – at chemical pulp station from drivers' perspective. For better illustration the student represented those findings in excel table. Tables 6 and 7 give an example of the dangerous event, which is possible to happen in RCP warehouse when truck driver enters the warehouse independently without permission, wheel loader driver performs his work not knowing that someone else is in the warehouse. Such behaviour can lead to the collision of the moving wheel loader with the walking man that most likely would cause serious injury of the stricken man. That is why the risk level is considered to be high.

Table 6. RCP Risk assessment. Part 1

Subject/event	Hazard	Description of hazard	Possible consequences
Truck driver enters the warehouse independently without permission, wheel loader driver performs his work not knowing that someone else is in the warehouse	Moving vehicle	Truck driver shows up unexpectedly from around the corner/bale, wheel loader driver doesn't have time to react, as a result, collide a walking man (collision)	Serious health effect or fatality

According Table 7, there is already a sign on the wall next to the warehouse entrance saying in three languages that it is driving in and walking in without reflective cloth, however, on practice it is not sufficient to prevent this to happen. Therefore, there are some future arrangements to be done in order to improve the situation.

Table 7. RCP Risk assessment. Part 2

Likelihood of occurrence	Current arrangements	Risk level	Future corrective arrangements
Possible	There is a sign next to the warehouse entrance in three languages (Finnish, English and Russian) saying "No drive without permission! No walking without reflective clothing!"	High	Add the rule of not entering the warehouse without permission to the updated instructions; change the gates so that it is not possible to walk into the warehouse independently, opened only by the wheel loader driver, make a separate room for the drivers to wait with the call up button

Tables 8 and 9 shows risk assessment for one probable case when the truck driver forgets to chock the wheels before the unloading process at chemical pulp station. This oversight can lead to the truck freely going backwards when the forklift gets into the body of a truck, as a result, uncontrolled vehicle crashes the facility objects or the workers on its way. This event is assigned with a very risk level.

Table 8. CP Risk assessment. Part 1

Subject/event	Hazard	Description of hazard	Possible consequences
Truck driver forgets to put the wheel blades under the wheels	Moving vehicle	The truck is not fixed before unloading, as a result, freely goes backwards when the forklift gets into the body of a truck or even after a slight push and crashes everything on its way	Property damage/ health injury

The proposed solution represented in the section “future corrective arrangements” of Table 9 for this problem is to make the place of wheel blades storage more visible and put the sign warning to chock the wheels. This also should be included in safety instructions and controlled by the operators.

Table 9. CP Risk assessment. Part 2

Likelihood of occurrence	Current arrangements	Risk level	Future corrective arrangements
Likely	Wheel blades are stored next to the platform	Very high	Make the place of wheel blades storage more visible and put the sign reminding to put them under the wheels; add the rule to the undated instructions; do not start unloading until they are at the place

Risk assessment in RCP and CP warehouses revealed occupational hazards and their criticality as well as highlighted the need for corrective arrangements in order to eliminate the risks associated with them.

Along with the observations, the researcher conducted the interviews. All the interviews were recorded by the author of the thesis with drivers' permission. As a result, the correspondent discovered that familiarising with the safety rules primarily depended on how experienced was the driver and how often one had already visited Kaipola paper mill before. In general, NBI drivers violated the rules less frequently since most of them had been transporting transport recovered paper to the UPM Kaipola plant for one to ten years on average once or two times a month. Through the interviews the author also knew that the drivers were instructed regarding personal protective equipment and some specific requirements before each shipping. All of the drivers said that they were instructed with general safety rules at least monthly but only a few of them saw the guidance specifically applied to the UPM Kaipola factory. However, some of them recalled that they were given some basic instructions a long time ago. First comers were usually on the phone with the experienced drivers or contact UPM Office in Russia. This is how the drivers explained their violations:

- It is inconvenient to work wearing helmet (falls down) or goggles (fall down or become steamed)
- Being in a hurry forgot to put some piece of the equipment
- No person to control
- Employer did not provide with all required PPE
- Trying to save time by moping the truck body and bringing the safety beams back step by step while unloading
- Staying close to the truck body while unloading due to a need of holding a truck tarpaulin (opening part) in order to help the wheel loader

- The construction of the truck does not allow to fold the belts outside the truck, the wheel loader gets muddled in the free hanging belts and often tears them up going backwards after picking up the bale

Figure 20 represents all those reasons with numerical data. Inconvenience of PPE and timesaving were the most common ones. Many of the drivers pointed out that helmet often fell down when they had to stoop while performing physical work, goggles had some scratches and became misted which impaired the visibility.

Figure 20. Most common reasons for violations (Interviews summary)

During the interviews the drivers were also inquired about the difficulties they ever faced while working at Kaipola mill – most of them said that they were not able to perform the weighting operation on their own at the terminal since the menu was available only in Finnish, Swedish or rather English (not Russian) and the provided instructions were not sufficient: some steps were missing or different from the actual ones, moreover, even in English version of the menu some steps were still in Finnish. Surprisingly, no one regarded language barrier in communication with the operators as an issue.

At the end of the interview the drivers were asked to give some suggestions for improvement:

- In order to prevent drivers from going inside the warehouse, change the gates and make a special room with ring bottom to call the wheel loader driver up in case he is not at the place for a long time;
- To reduce the number of steps in weighting procedure, make a Russian menu at the terminal or just replace the existing system with fully automated scales;
- Appoint an inspector checking the availability of all PPE and ensuring the compliance with the safety rules;
- In case rules are not followed, fine the transportation company or do not unload the truck;
- Ask the wheel loader driver to point out if any of PPE is missing to remind to put it on.

In addition to interviewing the drivers, the researcher contacted the UPM Russia office and several key carriers including forwarding company that represents one more communication hub and helps in searching for extra drivers. The thesis trainee managed to talk to Alexander Fedotov – Sourcing Manager at UPM Russia, Rimma Fedulova – representative of Truckline forward agency, Dmitriy Khummer – a director of NBI Transport Service and the owner of I.P. Shestakov carrier. According to Alexander Fedotov the safety instructions UPM Kaipola were received around five years ago (in 2012), two years after he obtained a memo with all the required PPE and approximately one to two years ago the weight bridge instructions. Alexander distributed all this information to the key carriers and forwarding company Truckline. Since then he did not receive any updates and was not informed about any issues with the drivers neither from the side of UPM Kaipola nor from the carriers. The director of NBI Transport Service said that UPM safety instructions were sent to him five years ago and weight bridge instructions three years later, drivers were instructed in terms of occupational safety once a month and warned about

mandatory usage of PPE before each shipping. Moreover, he did not receive any information about his drivers' violations from UPM. However, the drivers reported to him that they still had difficulties in using weight bridge system at Kaipola mill as provided instructions were not clear and automatic disruptions happened as well. Moreover, there was no guideline for the drivers coming to the mill for the first time. Rimma Fidulova was sending all the instructions received from Alexander Fedotov to the carriers and the drivers were instructed at their working places by the managers. She had never been informed about the violations. Vladislav Shestakov said that was regularly receiving safety instructions from Rimma Fedulova and instructing his drivers before each shipping. As he sometimes transported RCP to UPM Kaipola himself, he knew all the difficulties the drivers faced. Accordingly, it was very difficult to weight the truck at the terminal without operator's help, some PPE was inconvenient that is why the drivers avoided wearing it and one of the most significant issues was the poor quality of the supplied material which tangled the working process.

Data analysis of the safety documents, observations and interviews helped to identify different types of factors causing safety violations. Those are illustrated in Ishikawa diagram represented in Figure 21. There are six categories of causes. *Material* describes factors related to raw materials and information issues, for example, poor quality of paper piles. *Method* is associated with the operational processes such as no security control of coming trucks. *Machine* is mostly related to equipment failures as for instance disruptions in work of weight bridge system. *Man* means physical or knowledge work, cultural particularities and coordination problems. The examples of this type of factors are lack of communication with carriers as well as language barrier between foreign truck drivers and UPM operators. *Measurement* refers to poor assessment and monitoring of the operations – insufficient reporting system and *environment* represents external factors causing disorders – too much raw material in RCP warehouse.

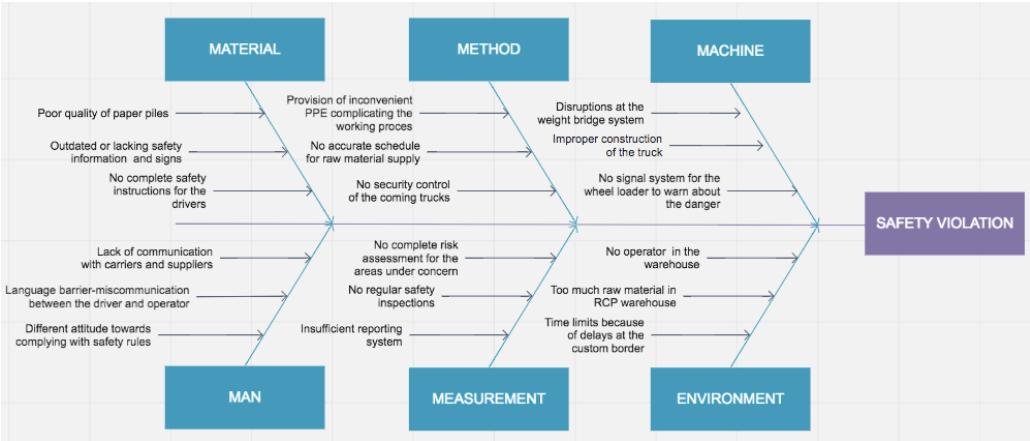

Figure 21. Causes of safety violation. Ishikawa diagram

Key issues leading to the safety violations represented in fishbone diagram were, first of all, the lack of communication with the raw material suppliers and carriers arranging the delivery to the paper factory as well as absence of complete adapted guidance in terms of safety and working process for the foreign drivers. Language barrier and different cultural perception of occupational safety required more rigorous approach to safety instructions and security control.

5.4 Cultural aspect

One of the root causes of occurred safety issues the author of the thesis discovered during the analysis was ***different attitude towards complying with the rules*** by foreign drivers, in particular, the ones who come from Russia. After studying the theory and survey conclusions of Hofstede described in chapter 3.2, the author of the thesis decided to use it for the research as well for comparison of Finland and Russia. Figure 22 generated from the website Hofstede Insights provides the relation between rates of all indexes defined by sociologist for Finland (blue columns) and Russia (violate columns). Three out of six indexes were picked up: power distance, individualism and uncertainty avoidance. To the researcher's point of view, those are the most relevant for comparison the difference in attitudes towards complying with the rules in two countries.

Power distance index (the greater the number, the more people accept that power

is distributed unevenly in the country). According to Figure 19, Finland scores 33 whereas Russia – 93. In general, Nordic countries are known for their high level of equality, therefore, Finland is featured by large middle class, legitimacy of power, equal rights and obligations no matter status. Whereas in Russia historically inequality is expected and desired: less powerful people should be dependent on the more powerful; people taking higher position in the organization have more privilege, respect and authority. In the thesis case it can be interpreted in a way that in Finnish working environment all the rules are represented the same to all the employees so that everyone is obliged and self-responsible to follow them while Russian low class workers such as, for example, drivers need to be controlled by the authority who has a power and leverage, otherwise, the regulations are not taken serious.

Collectivism vs Individualism index (the greater the number, the more uniqueness and independence is appreciated in the society). Index of Russia is 39, Finnish score is 63. Influenced by the Soviet Union past, Russians are considered as collectivists which means that laws and rights differ by group, opinions and behaviour of other members of group are reflected, occurred problems tend to be managed in groups whereas Finns are more individual as laws and rights are supposed to be the same for all and the decisions are, in general, made individually and responsibly. In my thesis case it was observed that Russian drivers tended to come to the mill team wise (usually two drivers at a time), in the interviews they often referred to other workers who did not follow the rules showing that this model of behaviour is normal – illustrative example is very important to them. Finnish drivers work independently and take the responsibility of meeting the requirements individually derived by law and natural necessity of self-protection.

Uncertainty avoidance (the greater the number, the more people feel threatened by uncertain/unknown situation). Russia rates up to 95 while Finland – only 59. Finnish people do not like uncertainty that is why they prefer to set up the precise rules and follow them – everything should be regulated. Russians also have really strong

uncertainty avoidance, for that reason very many different laws and regulations are established which makes it more difficult to comply with as they vary greatly per organization. During the research the author of the thesis realized that safety rules in different organizations were basically the same and were accepted quite a long time ago that is why for local drivers, for example, wearing a specific set of PPE already became a work-related habit while Russian drivers were confused with some requirements such as wearing goggles if they were never obliged before in other organizations and personally did not see a necessity of doing that.

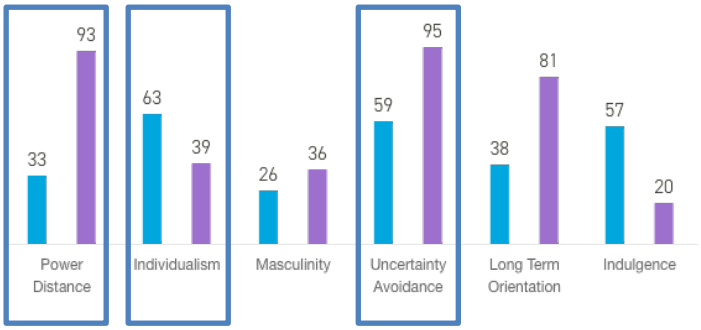

Figure 22. Cultural dimensions. Index comparison Russia vs Finland (adapted from Hofstede Insights, 2017)

Before jumping into results it is useful to make a summary of the analysis represented in Table 10. It provides the information about core findings revealed with the help of different RCA tools.

Table 10. RCA Summary

RCA method	Key findings
Flowchart	Violations at the stages: - arrival (first time) - weight bridge - upon reaching warehouse (in case operator is absent) - while unloading
Check sheet	**≈ 74 % of drivers** did not meet safety requirements Most frequent violations: - not wearing goggles in **≈ 69 % of cases** staying dangerously close to the truck body while unloading process in **≈ 44 % of cases**
Run chart	No of violations **dropped from 4 to 2 per month** after the official statement by the director of UPM Kaipola, Marko Laakkonen: *Truck is not unloaded till the driver has all the required personal protective equipment (PPE) on*
Cause-effect diagram	Core RC groups accounted for violations: **MAN** - lack of communication with carriers and suppliers - language barrier - different attitude toward complying with safety rules (supported by Hofstede cultural dimensions comparison) **MATERIAL** - outdated or lacking safety information and signs - incomplete safety instructions for foreign drivers **MEASUREMENT** - incomplete risk assessment of the working areas - no regular safety inspections insufficient reporting system

5.5 Results

As a result of analytical process, the author of the thesis was able to reveal several main root causes for safety problems regarding foreign drivers:

- **Different attitude towards complying with the rules**
  69 % of interviewed drivers did not understand the necessity of wearing goggles and avoided following the safety requirement unless any notice from the side of UPM employee had been given. 17 out of 23 drivers (≈ 74 %) did not meet at least one of safety requirements. The origin of different attitude towards complying with safety rules was explained in chapter 5.4 – Russians are used to take behaviour model from their co-workers and need to be examined by authorities to follow established rules. It means that there is a necessity to arrange some person in control or penalty for safety violations. Placing controls over hazards is an essential part of safety management system;
- **Lack of communication between supply chain hubs**
  According to cause-effect diagram represented in chapter 5.3., one of the man related causes is a lack of communication between UPM Kaipola and its suppliers and carriers. The survey of UPM Russia and major carriers' representatives showed that they were not informed about safety violations by the drivers. There is also no visibility when and in which form the information reaches the end user (in this particular case: the driver) which needs to be improved by UPM making more frequent contacts to their Russian side or providing the drivers with the clear guidelines directly at the place;
- **Obsolete set of safety rules available**
  The last updated instructions were provided to the carriers by UPM Kaipola in 2012. Therefore, drivers were not familiar with some new requirements established in UPM Kaipola since then. It means that the safety guidelines must be constantly updated and given to all the suppliers and contract

carriers in relevant language. There are also a few unwritten rules that should be included into general safety instructions related to the driver's position during unloading process;

- **Lack of signs and supporting guidance at the mill site**
  Most of the information is provided only in Finnish language (partly in English) such as mill site maps, warning signs and weight bridge system. According to conducted interviews, difficulties in using weight bridge system was the biggest concern of the drivers. Moreover, variation in behaviours of first-time coming and experienced drivers is considerable. The less experience, the more violations meaning more safety risks. It means there should be a special detailed guideline for those drivers. Moreover, some of the signs are quite old and not relevant anymore, therefore, everything must be updated and general information to be translated at least into English and Russian languages.

Interviews of foreign drivers, contacts with carriers' representatives, signs and instructions updates as well as involvement of warehouse operators into safety control process already brought some positive results and arose awareness about OHS importance of contract carriers. Based on summary of check sheets, the number of RCP drivers who did not follow the rules dropped from four to two per month. However, it is important to note that due to low demand of raw materials (planned summer shutdowns) and unscheduled arrivals of the drivers only 23 of them were observed for the whole period of traineeship (from May to August 2017). Therefore, the results are quite subjective and possibly would vary in case of longer period of research and greater amount of incoming trucks. Extra hazards emerged due to harsh weather conditions (especially during winter time) and different number of inexperienced drivers would influence the results as well.

Critical analysis of the research results can be found in Table 11. Four main criteria: validity, reliability, credibility and transferability are rated by average of their main components using a scale from 1 to 5. However, first of all, the meaning of these notions should be clarified. Validity refers to the degree to which a research accurately reflects or assess intended object of study – capability of answering the research questions. Reliability is concerned with accuracy of the actual measuring instruments – the research can be repeated with consistent results.

Credibility defines if the research results are trustworthy and supported by the researcher's findings. (Marsden 2013.) Transferability means that the research results may be useful for other researchers who are either involved or interested in research of the same kind (Green 2005, 62)

Table 11. Critical analysis of the research results

Validity	**4,00**	**Reliability**	**3,75**
Quality of conceptualization	5	Repeatability with consistent results	2
Randomized participation (within a group of Russian speaking drivers)	4	Pre-tested and standardized tools (for example, interview questions)	5
Extensive sample size	2	Data triangulation	4
Method triangulation	5	Competence of the researcher	4
Credibility	**4,75**	**Transferability**	**4,45**
Well-defined research questions	5	Applicable to other situations	5
Appropriate methodology	5	Generalization of findings	4
Systematic and comprehensive literature review	4		
Evidence-based conclusions	5		

Although based on Table 11 the research work can be considered as credible and transferable, validity and reliability of the results are still under question due to the fact that a sample size of observed and interviewed drivers is not vast to make unambiguous conclusions and can provide a limited view to safety violation reasons. Moreover, as the occurrence of violations decreased already during the research work (represented by the run chart in chapter 5.3), in case the research was conducted again, the results would not be consistent. However, it can be explained by the fact that the improvement started to be done along with the research process that obviously effected the situation.

Unfortunately, the researcher did not have and opportunity to repeat the experiment over and over but she had a chance to observe the same driver coming to the RCP warehouse in the end of May (29.05.17) and June (27.06.17), the second time he was also interviewed. Finally, these two observations were counted as one as the same violations were noticed – no helmet and goggle while the unloading process (see Figure 23). That proves that under the same conditions the driver tends to violate the rules in the same way. In this case the variation between observation 1 and observation 2 is zero meaning high reliability of the result.

Company / Date / Violation	Logistic Service 24.05.17	NBI Transport 29.05.17	NBI Transport 30.05.17	Premium Transport 30.05.17	Total number
No goggles	x	x		x	3
No helmet	x	x			2
No HV vest	x				1
No shoes	x			x	2
Inside truck body				x	1
Close to truck body	x			x	2

Company / Date / Violation	IP Shestakov V.V. 05.06.17	NBI Transport 05.06.17	NBI Transport 08.06.17	NBI Transport 15.06.17	NBI Transport 27.06.17	Total number
No goggles		x	x	x	x	3
No helmet					x	0
No HV vest						0
No shoes	x			x		2
Inside truck body						0
Close to truck body						0

Figure 23. Observations of the same driver

The process of root cause elimination is described in chapter 6 with a list of improvement proposals – actions the author of the thesis considered necessary to be implemented both in the nearest time (the ones which do not require many resources and can be applied within practical training period) and in the long run (the ones which are typically associated with considerable investments and can be undertaken in perspective of one to three years).

6 Improvement proposals

In order to solve root causes, the author of the thesis made a range of improvement proposals applied to general, RCP and CP operations. They were mainly divided into two groups: the ones that can be implemented within a short period of time (one to two months) without any special resources and the others that would require significant financial investments and can be considered in the long run.

6.1 General arrangements

- ***Actions in the first instant are:***
  - To make a specific set of requirements for local and international drivers transporting raw materials to UPM Kaipola;
  - To update the mill site map and add information in English and Russian languages. Provide contract carriers with a new version and place A3 laminated map at key points such as weight bridge, chemical pulp unloading station and others;
  - To establish an official statement: **Truck is not unloaded till the driver has all the required personal protective equipment (PPE) on!** and make the operators who directly work with the foreign drivers demonstrate relevance of this rule – do not start unloading until it is followed;
  - To reduce the number of contract carriers and stick with the most reliable ones in order to avoid the probability of a new driver not familiar with safety rules coming to the mill and make communication process between supply chain hubs easier.
- ***Actions in the long run are:***
  - To replace the existing gates by automatic system equipped with licence plate reader so that only preregistered trucks are allowed to enter the mill area;
  - To add more languages to the menu of the existing weight bridge system (at least Russian and Polish) or replace it by semi/fully-automatic system equipped with licence plate reader and barcode scanner so that all the information about the truck and transported cargo is directly transferred to the company database.

6.2 RCP operations

- ***Actions in the first instant:***

- To make a specific set of safety, behaviour and operational requirements for the drivers supplying recycled paper to UPM Kaipola at least in three languages: Finnish, English and Russian
- To create a step-by-step guideline for the drivers coming to the plant for the first time including the updated mill site map with the specified route to RCP warehouse. Forward it together with the developed rules in respect of safety, behaviour and operations to the contract carriers in Russia
- To make a detailed instruction for the truck weighting with illustrations and explanations in Russian language. Send them to the transportation companies and place the laminated version at the weighbridge next to the terminal (see Figure 24)

Figure 24. Weight bridge instructions

- To update the existing signs and memos at the weighbridge, transform general information into trilingual format;
- To place a sign: **Truck is not unloaded till the driver has all the required personal protective equipment (PPE) on!** next to the entrance of the RCP warehouse;
- To mark the unloading area and arrange a safe place for the drivers to stay while the unloading process as well as parking lots for the wheel loaders and tractors;

- To extend the fences of paper bales storage places to reduce the risk of them falling down on a person.

- ***Actions in the long run are:***
  - To use services of the carriers which have trucks with moving floor, tilt body or rotary dump as current unloading of baled recycled paper is quite time-consuming and risky so better find the way to supply loose paper instead of piles from Russia;
  - To install the electric gates so that the truck drivers are not able to enter the RCP warehouse independently;
  - To install the call up bottom next to the gates for letting the warehouse worker know that a new truck driver arrived.

6.3 Chemical pulp operations

- ***Actions in the first instant are:***
  - To make a specific set of safety, behaviour and operational requirements for the drivers supplying chemical pulp to UPM Kaipola at least in three languages: Finnish, English and Russian. Send these instructions along with the updated mill site map showing the route to chemical warehouse to the contract carriers;
  - To put a trilingual (Finnish, English and Russian) sign on the wall next to the unloading deck stating: **Chock the wheels before unloading!** and mark somehow the area where the wheel chocks are located
  - To place a sign: **Entry the warehouse without permission is forbidden! Truck is not unloaded till the driver has all the required personal protective equipment (PPE) on!**
  - All the drivers should be aware of that **unloading is not allowed during the time 6-10 am and 3-7 pm due to VR carriage transfers**, therefore, place the sign stating that on the wall next to the unloading deck, mark/fence the area with traffic cones/warning ribbon for the

time of this operation and arrange a parking place for the drivers to wait in case they came at these hours

- In addition to the mill site map create a scheme dividing the unloading area into three zones: dangerous, risky and safe and, therefore, showing the driver where to stay while the unloading process (see Figure 25). Both maps should be placed on the wall next to the unloading deck;

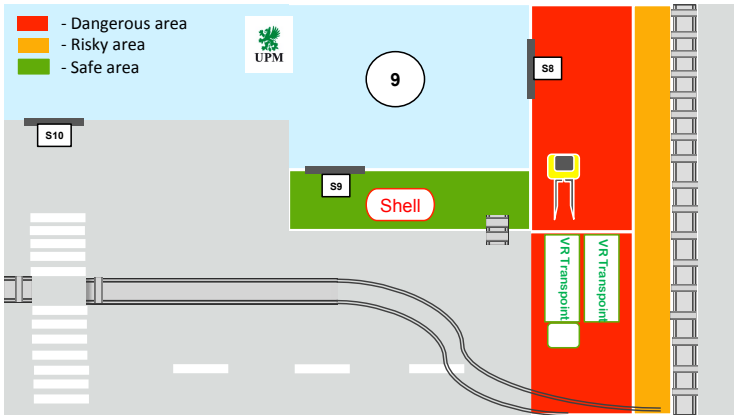

Figure 25. Chemical pulp station map

- To remove the old unused “Shell” gas station from the safe area;
- To attach rubber bumpers to the contact side of the unloading deck to prevent platform damage caused by inaccurate truck parking (see Figure 26).

Figure 26. Rubber bumpers in the unloading area

- ***Actions in the long run are:***
    - To install a call up bottom next to the loading deck for letting the warehouse worker know that a new truck driver arrived

Some of the arrangements such as updating safety instructions were already applied during the traineeship period, however, unfortunately, the author of the thesis did not have an opportunity to see how the rest of them were implemented and if it ultimately improved the situation at UPM Kaipola. Therefore, considering the development of the thesis work, it would be valuable to repeat the research within a shorter period of time, but under the same conditions and using the same research methods.

7 Conclusion

The research work evidenced that occupational safety is crucial not only from perspective of employees' well-being but also in terms of logistics operational efficiency. Even minor work incident can bring numerous disruptions in the supply chain such as delays, excess stock, shortages of raw materials and others as well as many indirect costs that are often not taken into consideration. That is why these days there is a number of organizations in Europe as, for example, EU-OSHA, working

on developing of fundamental safety principles and standards that should be applied in each company. However, growing network of international channels creates challenges to ensure the compliance with safety management systems throughout different logistics hubs of a company, especially outside European Union where safety regulations and controls as well as safety culture perception may vary.

UPM Kaipola study case is a great demonstrative example of how a sustainable company aiming to become the industry leader in safety still faces difficulties dealing with foreign contract workers. During the research it was revealed that the UPM safety management system needs to be improved and adapted to specific groups of employees (Russian-speaking contract carriers). Based on content analysis of related safety documents, observation and interviews of the drivers, the researcher made a conclusion that it is necessary to update and enlarge safety guidance, involve operators into safety control process and maintain information exchange both with suppliers and carriers. That way the company is able to raise awareness of its partners about safety importance and gain better control over their operations, thereby, considerably reduce risks of incident at work and enhance its logistics operational efficiency. Due to relevant credibility and transferability of the thesis work, applied research methodology can be also used to study analogic problem in other companies.

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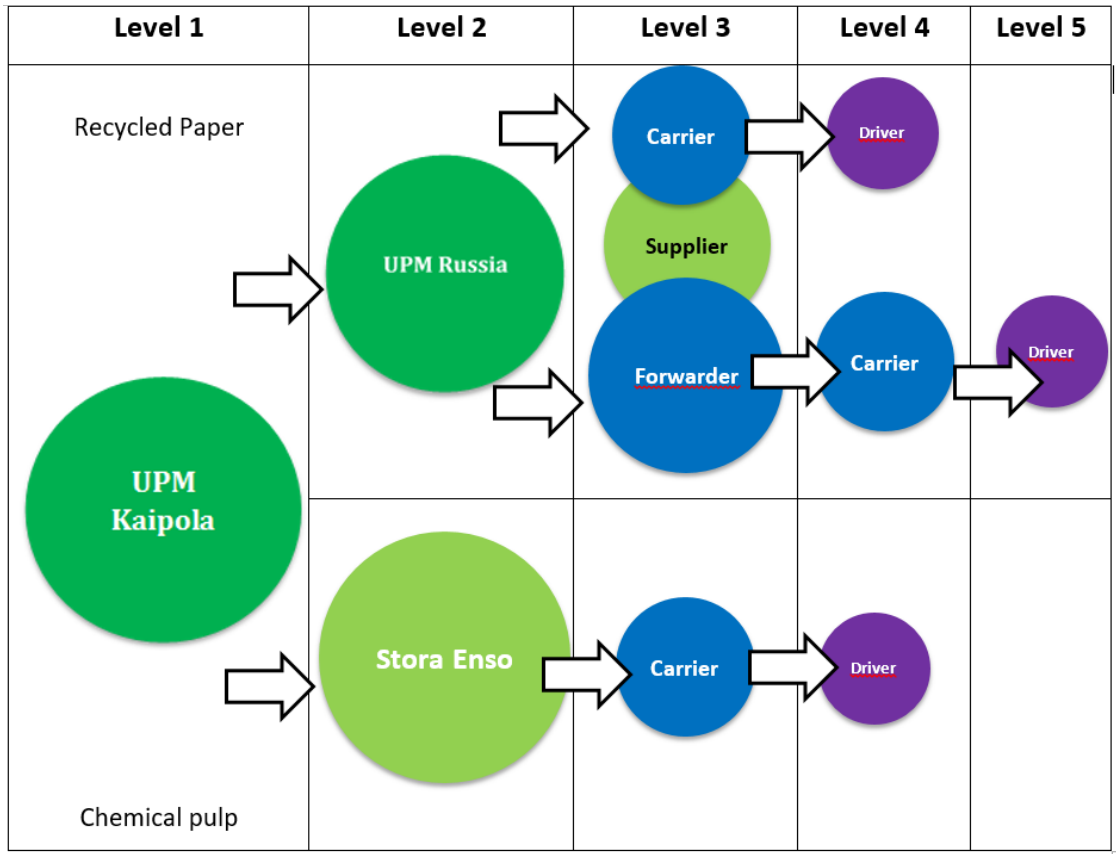
Appendices

Appendix 1. Key Performance Indicators. UPM Kaipola. May 2017 (adapted with permission)

Indicators	Category for UPM Kaipola 2017
Safety	
LTAF (lost-time accident frequency)	improved
TRIF (total recordable injury frequency)	improved
Safety observation factor	weak
Sick leaves	weak
Safety culture level	improved
Customer satisfaction	
Customer claims €/t	KAI4-weak, KAI6 & KAI7-target
Customer claims pcs1000 t	KAI4-weak, KAI6 & KAI7-target
Cost effectivenes	
NHS %	KAI4 & KAI7-improved, KAI6-weak
Power factor	KAI4-improved, KAI6-weak, KAI7-target
Variable costs index	KAI4 & KAI7-target, KAI6-weak
Total costs index	improved
Overheads index	target
Power factor (general)	improved
Electricity consumption, MWH/t	target
Personal strength	target
Productivity	target
Environmental friendliness	
Water use m3/t	improved
Chemical oxygen demand (COD t/d)	target
Nitrogen kg/d	target

Appendix 2. Flow of information from UPM Kaipola to a driver. Five communication levels



Appendix 3. Interview questions

1. Hello! My name is Maria. I'm a student of JAMK. At the moment I have my internship in this organization and as part of it conduct a research to reveal the reason of safety violations by contract workers. Could you please take part in my interview that will take no more than 10 minutes?
2. So at first introduce yourself. What is your name and in which transportation company do you work?
3. How often do you supply raw materials to this organization?
4. Have you been instructed in terms of occupational safety? Where and how?
5. Did you have to verify that you are familiar with the general safety rules, for example, by being tested? Did you have to put your signature as a confirmation of having been instructed? Do you have a safety card?
6. Are you familiar with the safety rules of this particular organization? Have you seen these safety instructions for the drivers? (Show the memo)
7. Who provides you with the required safety equipment (helmet, high visibility vest, safety glasses and shoes)?
8. How often can you have breaks for smoking/having snack/etc.? Do you know that it is prohibited to smoke within the whole area of this organization?
9. Tell me step-by-step how the process goes from the moment you enter the main gates?
10. Do you have any difficulties at the weighbridge point? Do you weighting by yourself?
11. In case you have to wait outside till another truck gets unloaded, what do you usually do? How much time does it take?
12. What do you do in case the operator is absent?
13. What do you do while your truck is being unloaded? How much time on average does it usually take?

14. How do you communicate with the operator?
15. What difficulties have you ever experienced when working at this mill?
16. Do you think that the safety instructions you had and all the provided memos/signs are sufficient and clear to follow? What should be changed/improved?

Appendix 4. Flowchart: Representation of a driver's working process at UPM Kaipola