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# Checklist for project management in wind power logistics

## Creation of a checklist based on work breakdown structure

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Abstract

The study was assigned by Transport Company Ville Silvasti Ltd, which is a provider of heavy and oversized transports. Their main market area is wind power logistics.

Wind power is one of the methods of producing renewable energy. Wind is emission-free energy, which is converted into electricity with the help of a wind turbine generator. Building of wind parks that consist of many wind turbine generators is strictly regulated by different authorities. Wind power logistics is a special field of business where large and heavy components are transported from port to site with special equipment. Therefore, project management in wind power logistics is relatively complicated and requires high expertise.

The objective of the study was to create a checklist for project management in wind power logistics. Wind power projects have grown so big that their management creates challenges for transport companies. There are many activities that are dependent on each other. Each project is a unique entity and their scope varies. Furthermore, the duration of the projects can be many years including the sales and planning phases.

The study was implemented by collecting material from the assignor company and creating the checklist as an outcome of the research process. Informants were selected inside the company, and they were interviewed. Their answers were analyzed with content analysis.

As a result, central issues and the greatest challenges were put together. These key findings created the baseline for the creation of the project management tool.

Defining the dependencies and illustrating the project visually was the ambition of the assignor company. This checklist for project management meets their demands.

Keywords/tags (subjects) Silvasti, Special Transport, Checklist, Project Management, Logistics, Wind Power, Work Breakdown Structure, Gantt Chart, Critical Path, Precedence Diagram

Miscellaneous (Confidential information)
Parts of the thesis are restricted by the assignor company's request. The hidden sections may contain business secrets or competitive advantages that could cause undesirable harm to the company when revealed to larger public. This version is the public version where restricted contents are put to appendices and the term of confidentiality of the appendices is 25 years from the date of the thesis approval.

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# 1 Introduction

## 1.1 Background

Wind power has retained its position as one of the megatrends in the energy business. It is renewable and emission-free energy where the environment is taken into consideration in all the phases, from building a wind farm to operating it for decades. The building of wind farms is carefully monitored by different authorities in order to keep the environmental impact at minimum. Wind power logistics is a field of business where expertise must be on a high level for fulfilling the needs of demanding customers with high expectations. Wind farms are often built in difficult locations, such as mountains, which are not easily accessible with oversized and heavy loads. The sizes of the wind turbine components are increasing constantly, and this requires new innovations from the transport companies.

Wind turbine generators are becoming bigger and more powerful constantly. This leads to a significant increase in the component sizes. The blade lengths and tower heights are increasing rapidly. The components are becoming so big that the manufacturers are struggling to find ways how to divide wind turbines into smaller sections, so that the logistics would be easier and cheaper. The towers are already divided into several sections, but currently, there are no existing solutions for how to split the blades while maintaining their structural strength and properties because the blades must tolerate heavy winds during their lifetime.

Assembling a wind turbine is rather expensive because a giant crane is needed to the site. Smaller cranes are also needed to assemble the bigger crane. Therefore, it is reasonable to build many wind turbines in the same area, so that the transport distances of the expensive crane can be kept at minimum. A great deal of equipment and labor is required on site, and it is practical to complete the whole wind farm before the demobilization of the equipment.

Successful wind power logistics requires very good project management and a skillful team of experts to make the correct decisions and to ascertain that the budget is not exceeded. Behind all the large projects, there are numerous issues and problems

needed to be solved during the process. Some of these issues are how to monitor the progress of the project as well as determining which phases are completed and which ones are the next possible problems that need all the focus in order to avoid delays.

It is occasionally difficult to know exactly the current situation with the project, when there are so many project related tasks to be done. This is especially true in an international project that continues for years and in which many persons are involved. Every step contains several different tasks that all are important for a successful project. Each person has his/her own area of responsibility, which contains plenty of activities. With all the tasks, it should be clear who will execute them and where the needs for a subcontractor are.

In the planning phase of a project, tasks should be carefully listed to avoid any tasks being forgotten. If something critical has been forgotten, it can cause many kinds of problems and mistakes. Tasks and functions which do not have any person in charge are being forgotten easily. (Mäntyneva 2016, 71.)

The solution for this problem is a checklist for project management, which will help the project management team to follow the general progress of the wind power project. This checklist contains all the necessary information concerning the phases which are critical to perform. It is a summary of the whole project for the managers. The solution is important for the assignor of the thesis, Transport Company Ville Silvasti Ltd.

## 1.2 Transport Company Ville Silvasti Ltd

Transport Company Ville Silvasti Ltd is a major Nordic provider of heavy and oversized transports. They operate in Europe and in Russia, and ship special cargo between continents. The company was originally established by Jukka Silvasti in 1971, and he sold the company in 1989. Jukka's son Ville Silvasti started his own business in 2002, and the company grew rapidly and finally in 2015 Ville Silvasti acquired the company that his father has founded in the 1970's. In the year 2017, Transport Company Ville Silvasti Ltd acquired the Danish special transportation

company Frank Nørager & Co. A/S, and after this acquisition Silvasti became the most important player in the special transportation industry in Northern Europe.

Transport Company Ville Silvasti Ltd has currently offices in Finland, Denmark and Russia. The turnover is around 50 million and there are around 180 persons working in the company.

# 2 Research approach and methods

## 2.1 Qualitative research

Qualitative research is a method used for forming a better understanding about the topic and finding an answer to the question “What is this phenomenon all about?”. Qualitative research offers an opportunity to gain deeper understanding of the topic, especially when there is no existing information, theories, models or research available. The researcher wants to understand the phenomenon. (Kananen 2017, 32.)

## 2.2 Why qualitative?

The qualitative research approach was chosen for this bachelor’s thesis. In this case, a qualitative method suited well for the author’s purposes, and the selection between qualitative and quantitative was clear from the beginning.

Quantitative research requires accurate questions because the research can easily miss something important during the material collection if questions are incorrectly formed. Therefore, the phenomenon must be familiar to the researcher in quantitative research before starting to collect material for analysis. Otherwise, there is a risk that the results can be correctly formed and analyzed, and the research is executed properly, but the researcher has been focusing on completely wrong issues in the questions. The questions themselves can be wrong or the options for answering might not include the relevant answer at all. In this case, the whole research can miss the main point. Qualitative research is a more suitable option if the phenomenon is not known very well, or the information available is limited or lacking

in some essential details. Complicated processes can only be explained with the help of qualitative research. The methods can be mixed for filling all the gaps in the research. This can be done either by using many methods simultaneously or by alternating the methods after each other. Flexibility is one of the benefits of qualitative research because the researcher has many different opportunities to choose from depending on the focus of the particular research. (Kananen 2015, 70-71.)

The figure below (See Figure 1) shows the general process of data collection and analysis in qualitative research. After the theorical framework of the study has been defined, and a literature review has been written, the methods of analysis can be selected, and the data is analyzed according to the selected methods. The results can be compared and validated, and finally conclusions can be made.

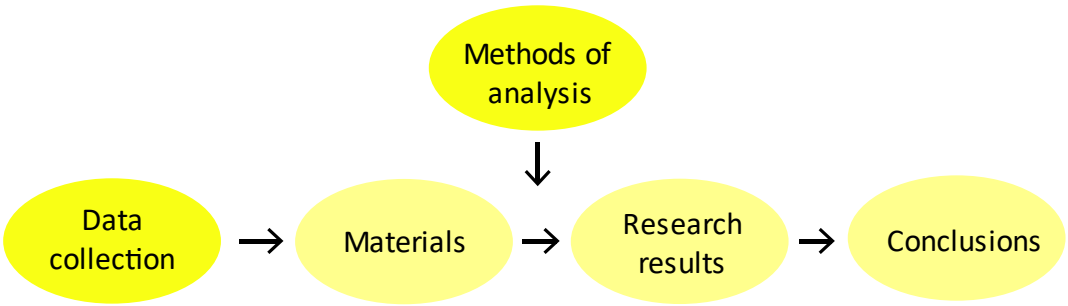



Figure 1. Qualitative research process. (Kananen 2015, 80)

## 2.3 Design research

> ***Design research does not produce only text but practically working solutions (Kananen 2012, 42).***

Design research aims for changing or developing a certain matter. The target of the change or development can be, for example, a product, a process or an organization. The results may be implemented in real life or left on a descriptive theory level. Research only focuses on a research problem, which is defined beforehand, and the results are relevant only with this particular phenomenon. Naturally, design research can be utilized also elsewhere by applying the elements of the actual execution of

the change process. The results, and most of all, the methods of managing the changes can be helpful to, for example, an organization which is struggling with similar problems. Commonly known mistakes should always be avoided. The researcher tries to spread his/her knowledge to others so that they can learn something useful from this scientific research. Design research becomes action research when the researcher is actively participating in testing the solution and its functionality. (Kananen 2012, 42-43.)

According to Kananen (2012), design research is usually conducted by those who are combining studying and working together. Work experience from the company that is the assignor of the thesis, helps drastically during the process. Developments are much easier to make, when the researcher already understands the phenomenon and might already know where the targets for improvements are. A downside can be mentioned that the researcher can be too close to his/her own working environment and cannot see things objectively. Personal experiences and previously learned habits might limit the researcher's ability to develop the existing processes. Changes are often uncomfortable, and development requires a new perspective to matters. Therefore, it is sometimes easier to use an external consultant in important issues because the consultant can see things completely differently and identify the problems instantly. A positive aspect is that if the researcher works in a company that is also the assignor of his/her thesis, the level of commitment can be high. The results can be helpful for the researcher, and he/she can be proud of the developments or improvements in his/her work community. Most of all, writing a thesis for the company where the researcher is working, can help with the future career. (182-183.)

## 2.4 Objective and questions

The objective of this research was to find practical solutions for issues which wind power project management encounters. Wind power projects are complex projects that can take for many years to complete. The projects start from planning and tendering and end to the handling of claims and receiving feedback from the customer. For the Transport Company Ville Silvasti Ltd, the actual execution of a project is the core business, and therefore the company has a continuous process for

finding improvements for the existing methods. If something can be done better, it should be done so. If there are bottlenecks, delays or even claims, those issues should be handled properly and solved. Monitoring the progress of a project is difficult, and therefore, project management tools can make this follow-up slightly easier. The company had a need for a user-friendly checklist that would contain all the necessary information regarding a project.

The study aimed at a better understanding of how the process between the sales and the start of the transportation phase was supposed to perform so that the planning phase would enable a successful execution phase. Even the smallest detail can cause a massive delay, if it is a critical element that has to be performed on time. Those important details should be recognized, and the aim of this research was to create a project management tool which could significantly help to follow every step that is crucial from the project management's point of view.

First, the objective was to examine how things were done at the time of the research project and where the possible bottlenecks and issues were that were creating delays easily if not acted upon on time. The data is collected with the help of thematic interviews which gave valuable information about the current state of the project management. The informants came from the assignor company. The position and duties of the informants may have had an effect on their opinions on which information was essential to them. This fact was considered carefully, and it was taken into a consideration at an early stage of the research process. Suitable persons were selected from the assignor company. As time was limited for conducting this research, all the employees from the case company were not informants in this case. A small sample from the company was considered to be comprehensive enough in this case. This particular group of informants gave input for the data collection inside the company.

Secondly, the interviews were analyzed by using content analysis. The recorded interviews were transcribed into text form, so that making conclusions and comparing the answers was possible. All the phases were documented in order to make this research reliable and scientific.

The conclusions are discussed in the Conclusions chapter where the final solutions are introduced. The topic was familiar to the author at this point, and the final conclusions could be formed when the data collection was conducted properly and the amount of information was sufficient.

The research questions of this bachelor's thesis were:

1. What are the biggest problems in completing a wind power project?
2. What kind of checklist for project management is functional for the Transport Company Ville Silvasti Ltd?
3. Which are the phases in a wind power project, and what factors should be taken into consideration for executing a successful project?

## 2.5 Limitations

Wind power logistics itself would be too broad a topic for a bachelor's thesis. Instead, this research focused on wind power project management in the field of logistics. The research was assigned by Transport Company Ville Silvasti Ltd, and therefore, their perspective to the matters was considered. Benchmarking methods were utilized in this research, but due to challenges in the data collection, it was possible that the obtained data was limited concerning certain crucial matters. The time was also limited because the research process was planned and scheduled to be conducted during the year 2019. Thus, it was not possible for the author to follow and observe a project completely from the beginning until the very end because the whole process could take many years.

It was decided that this thesis would focus mainly on the process after a project is sold and confirmed and when the actual execution begins. On the other hand, it would have been too difficult to include all the steps during the actual transportation phase at the end part of the project. Therefore, the study mainly focused on the project planning phase, which contained all the tasks that needed to be done before the actual transportation was possible.

# 3 Wind energy in brief

There are currently numerous different renewable energy generation systems available, such as wind energy, wave energy, solar energy, natural gas and biomass. Wind energy has achieved a solid status amongst all the renewable energy systems. It has taken the leading position nowadays when fossil fuels are becoming less attractive as sources of energy. Wind energy never runs out, and it is available everywhere. What makes wind energy so attractive, is the fact that it is free and does not require any fuel in order to operate. A wind turbine does not use any water or carbon when operating, and it does not pollute the nature around it. The production of wind energy is easy to increase, and a wind turbine requires only a small piece of land where it can be built, because the surface area of the wind turbine foundation is relatively small. (Brown 2015, 119.)

The building of a wind turbine happens relatively fast compared to other energy sources. For example, building a nuclear power plant can easily take a decade, while a whole wind farm is usually built in under a year (Brown 2015, 125).

## 3.1 Wind energy in Europe

Europe is one of the pioneers in developing sustainable energy generation solutions. Wind power has become a success story during the past two decades. The European Union has provided an opportunity to wind power manufacturers to penetrate the highly competed energy business by offering support mechanisms, such as tariffs for increasing the market share of wind power. Europe has achieved a solid reputation of favoring sustainable energy. The image of the whole continent is improving with favoring renewable energy. Fossil fuels are running out, and their prices will rise in the future.

Markets are growing rapidly, and awareness of renewable energy is spreading steadily. The population is more and more interested in knowing the origin of the electricity that they are consuming. Sustainable energy is also attracting the European investors. According to WindEurope (2019), out of all the investments in renewable energy, 63% was made in wind energy alone in the year 2018. That means

the total amount of 26.7 billion Euros in 2018 (See Figure 2). In the previous year, 2017, the percentage share was only 52%.

For Transport Company Ville Silvasti Ltd, this yields a significant number of new wind power projects every year. Silvasti conducts onshore projects in the European region, and according to WindEurope (2019), the total worth of investments made during 2018 in renewable energy was 16.3bn euros. The company needs to have an enormous fleet of vehicles in order to be able to conquer the Nordic markets as a special transportation provider. Every year is busier compared to the previous year. There is certainly now an economic boom in the field of wind energy.

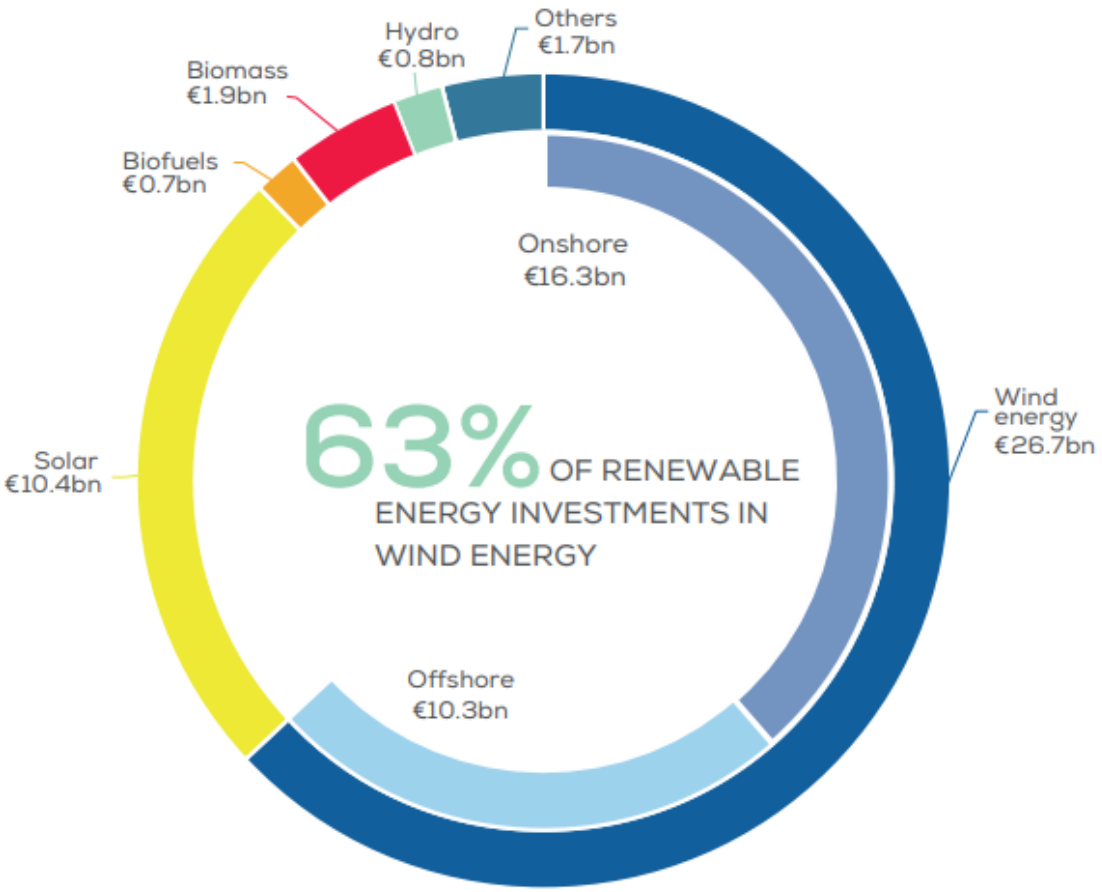



Figure 2. Renewable energy investments in 2018 (€bn). (WindEurope 2019)

Wind power has been the second largest power generation form after natural gas since 2016. It is predicted that wind power will probably overtake natural gas during 2019 (See Figure 3). In the year 2018, a total of 11.7 GW of new wind energy was

installed in the European Union. There are currently 189 GW of installed wind power generators in the European Union area. Out of this total amount of 189 GW, 19 GW is built offshore and 170 GW onshore. Of the European Union's energy demand, 14% is met with electricity produced by wind power. (WindEurope 2019.)

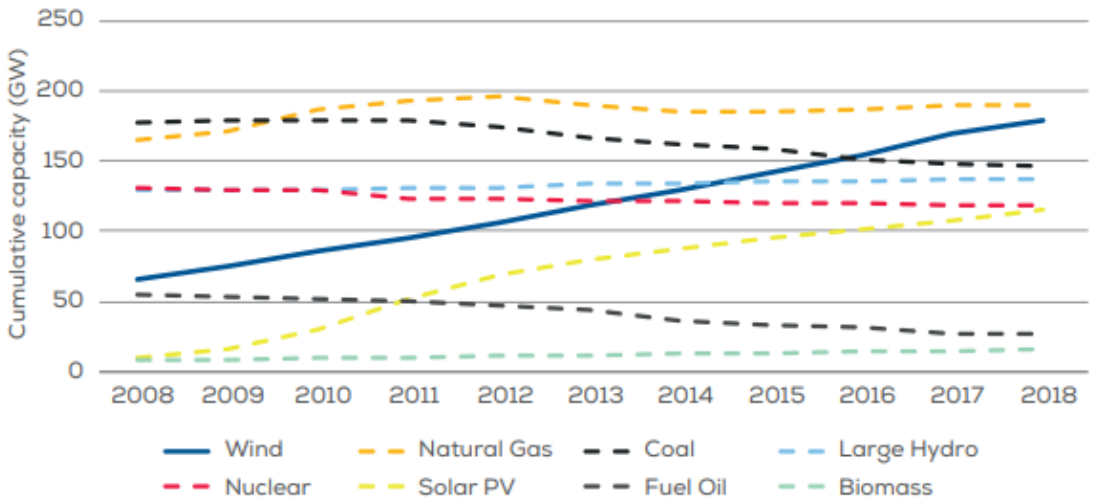



Figure 3. Total power generation capacity in the European Union 2008-2018. (WindEurope 2019)

## 3.2 Wind turbine components

In general, a wind turbine generator consists of a tower, rotor and engine room, which is called a nacelle. The tower can be divided into several sections, depending on the size of the wind turbine. The blades and a hub form the rotor, which is connected to the nacelle. Inside the nacelle are all the technical components, which are used for turning the wind energy into electricity. The nacelle consists of a gearbox, generator, yaw bearing, yaw motor and instruments measuring the wind speed and direction. The rotor is always turned against the wind direction for maximizing the benefit. This turning around the wind turbine's vertical axis is called "yaw control". (Korpela 2016, 49-50.)

The number of the blades is typically three in wind turbine rotors, because it has been proven to be the optimum economically and because the stability is already sufficient. In theory, fewer blades means a cheaper price of the wind turbine. There

are some wind turbines with only one or two blades, and they are very economical because they have less material used in the blades, but their stability is not very good. Unstable spinning leads to significant stress affecting blades themselves as well as the power transmission. With fewer blades, the rotor must spin faster so that it can create the same amount of electricity compared to models with more blades. In fact, a wind turbine with only one blade must spin three times faster than a model with three blades so that the same amount of energy is produced. One or two blades cause unwanted power losses because of frictional loss that creates heat energy. The more blades the rotor has, the more stable it is and the less noise it creates to the surrounding environment because it spins more slowly. On the other hand, when considering the economic point of view, blade material is expensive, and it should be carefully optimized so that the wind turbine can create cheap, sustainable energy. Therefore, three blades in a wind turbine have been found to be the optimal solution when considering both technical and economic points of view. (Korpela 2016, 66-67.)

Currently the biggest operating offshore wind turbines in the world are located in the United Kingdom. MHI Vestas Offshore Wind connected two V164-8.8 MW models in a wind farm belonging to the European Offshore Wind Development Centre. These were built in 2018 and the rotor diameter was 164 meters with the power rating of 8.8 MW. (WindEurope 2019.)

However, GE Renewable Energy built an even bigger onshore wind turbine in front of the City of Rotterdam in the Netherlands during the summer of 2019. This prototype is called Haliade-X and the power rating is 12 MW. The rotor diameter is massive 220 meters, with blade length of 107 meters. The total height of Haliade-X is 260 meters. (Tomas Kellner 2019.)

## 3.3 Wind farm

A wind farm requires only a very small surface area from the land where it is built. When wind farms can cover several square kilometers, they need only a fraction from this total area when operating. Typically wind turbine generators, including roads and other permanent structures, cover only a percent of the wind farm’s total area. When comparing the actual land area with energy generation, wind energy is

highly efficient. The land around the wind farm can be utilized, for example, for agriculture and cattle breeding. This leads to significant increase of productivity for farmers because they are paid for the usage of their land. Farmers can use their land normally while the wind turbines are generating electricity from the wind. (Brown 2015, 122-123.)

A wind turbine generator needs a strong wind to operate properly. Therefore, wind turbines are usually built in harsh conditions. Onshore models are often built on top of a mountain to avoid any obstacles in front of the turbine. On the other hand, offshore wind turbines are built on sea level. Thus, they are often built quite far away from the coastline to maximize the wind. Some cities and ports are so busy that there might be buildings or even enormous ships blocking the wind.

## 3.4 Wind power logistics

A wind power logistics is a business where the transport company is transporting components for a wind turbine generator. Complicated logistics chain starts from a component supplier which has manufactured the wind turbine generator components. The components are transported from a factory with trucks to a port, where the components are loaded into a vessel and shipped to the destination country. The shipping is made to the nearest suitable port, and the port itself has several criteria that it can be selected. Firstly, there must be enough storage space nearby that the components can be stored after unloading. The components are loaded to the trucks and transported to the wind farm. Secondly, the port must be big enough that the vessel can access it. Strength of the quay is inspected, that it can bare the loads affecting to it. If the quay is not strong enough, it must be strengthened. Lots of space is required in the quay area, that the unloading can be performed safely. The components are stored after the vessel has been unloaded and they are transported to the wind turbine site according to a schedule. There are numerous of factors affecting to the transportation schedule, for example, driving bans with an oversize loads or the lack of storage space on site, and therefore “Just In Time” -principles must be applied to the component transportations. It makes no sense that all the components are transported to the site simultaneously, because erecting the wind turbine is conducted in a certain order anyway. It starts with a

bottom section, then the tower sections are lifted on top of the previous vertical sections. When the tower is assembled, then a nacelle is lifted on top of the tower, and it follows with hub and blades.

# 4 Project work in brief

Projects are conducted so that certain objectives can be fulfilled. It starts from a need or from a demand of certain product or a service. Aim of the project is to deliver the finished product or the service so that it can be utilized by customers in the future. According to Ruuska (2012, 20), a result from a project does not have to be a concrete product; the result can also be a solution to a certain problem.

The project can be measured with several performance indicators, and the scope of the project defines what is the most critical matter to follow, and where are the upper limits for the resources in certain area. Lööw (2002, 18) states that there are at least three different performance indicators; following the schedule, following the budget and delivering good quality which fulfills the functional requirements of the project.

## 4.1 What is a project?

According to Mäntyneva (2016) a project is an unique, coherent entity, where the resources are limited. A time, costs and scope of the project are defined and limited beforehand. The project is a sum of tasks and activities which does not have been conducted exactly similar before. It leads to the uniqueness of the project. (11.)

The projects are clearly considered as a result orientated, and this helps prioritizing mutual activities in a project organization where decisions are made together, and the organization shares the same goals. (Mäntyneva 2016, 9). The projects often includes meetings and a situation reports, for helping to evaluate that current progress satisfies the agreement and all the requirements that the customer has set.

The objectives of the project should be clear for every participant during the whole project in a successfully implemented projects (Mäntyneva 2016, 10). If there are lots

of unclear matters, it can easily lead to a misunderstanding and mistakes. A simplicity in defining the tasks helps the staff to get better understanding about their duties.

If the objectives are not clear to all working with the project, it can significantly delay the progress. Conflicts should be avoided so that the objectives of the project can be achieved faster. (Berkun 2006, 333.) It is the managers responsibility to check that the objectives are clear to all.

There can be several levels of objectives depending on the size of the project. A structure can be seen in Figure 4. In general, an individual employee agrees the objectives with his/her manager, and the team agrees the objectives with the upper level. It can be a customer, a project contractor or other party. It is important to remember that there can be many different operators, each conducting certain part of the project. These all operators and companies all have their own objectives which they must follow.

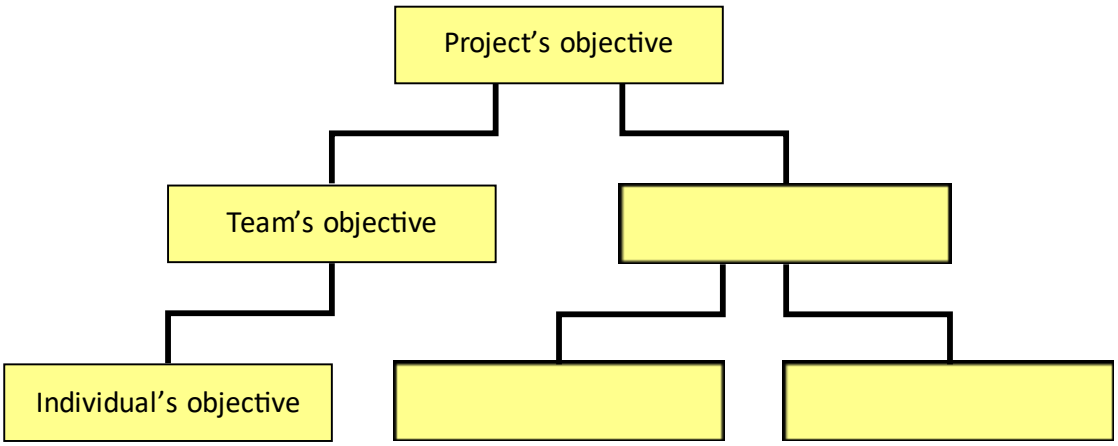



Figure 4. Three levels of objectives. (Adapted from Berkun 2006, 90)

### 4.1.1 Life cycle of a project

A project has many phases, and Mäntyneva (2016) defines project's life cycle with four phases: preparation, planning, execution and ending (See Figure 5). The starting and the ending times has been defined beforehand, and the time between these defines the duration of the project. When considering the general view of the project, dividing the project into four main parts helps to understand it better. (15.)

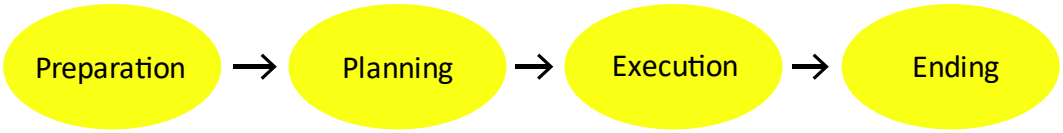



Figure 5. Life cycle of a project. (Adapted from Mäntyneva 2016, 15)

A large, complicated projects contain so many details that it can be difficult to get a grip from the main idea of the whole project. Simplified pictures help to share the life cycle of a project to every participant. It may be necessary to show and explain the phases to the customer who does not understand every detail or the amount of work it takes to conduct.

The preparation phase may take many years before an actual start of the project, even decades in some infrastructure projects. If the preparation phase is done properly, it makes the actual execution much easier for the project, and the planning phase will be significantly easier to conduct. (ibid., 15-16.)

The planning phase is started when the decision to start is made. All the risks related to the project should be identified, and a plan how to deal with them is written in a separate project plan. The schedule, costs and resources must be carefully evaluated and planned at this point, to avoid any unwanted surprises in later parts of the project. The duration is defined, and the project is planned. (ibid., 17.)

The planning phase requires a good definition of the project what is being executed after planning. If the activities cannot be defined, it is too early to start thinking how to do it (Berkun 2006, 54). Figure below (See Figure 6) shows the general order of the planning phase. The simplicity of the execution phase can be observed from the figure, after the activities are carefully planned, tasks should go smoothly in the execution phase.

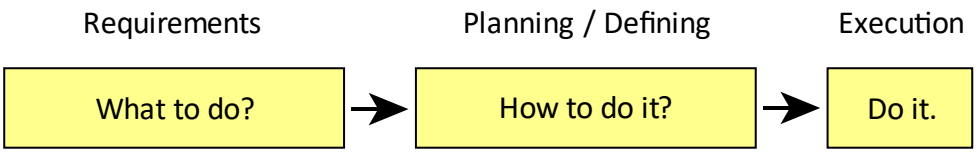



Figure 6. Practical perspective to planning. (Adapted from Berkun 2006, 54)

The execution begins after the planning is made. At this point, the main idea is to follow the previously written project plan, which contains all the details concerning the project. If problems occur, they must be identified and solved quickly. The problems are tried to solve as fast as possible. (ibid., 17.)

The final phase is ending the project. The final report is written, and the project is evaluated. If the final result differs drastically from the project plan, it is written into the final report. The project is documented and evaluated from the learning point of view, so that the next project could be conducted with less effort, and possible mistakes could be avoided. The goals of the project are reconsidered, and the result should fulfill all the goals. It is important to check that all the tasks are actually done. (ibid., 17-18.)

### 4.1.2 Scheduling

A good scheduling is important in a big, complex projects, because there are many dependencies between the participants. The decisions and the timings are affecting to many persons. In the smaller projects with the smaller teams, if some of the activities are overdue, it is easier to catch up the time what is lost. A small team can easily decide together how to catch up the original schedule, and how it can be done. In the larger complicated projects, there are so many persons involved that even a one day delay can cause a significant problems that could not have been predicted beforehand. (Berkun 2006, 30.)

Making a time estimates is relatively difficult in a complex projects, where the duration is long. The estimations which were made to the future, might not be correct. Therefore, some methods are developed for making a better time estimations. The estimations and guesses should be separated in a significant projects.

A reliability of the estimations can be evaluated by using percentages. The estimation, which is actually only a guess, should be excluded or evaluated using, for example, percent value of 40. This guess might be correct but there is a risk that it is completely wrong. Instead, a good estimate from an experienced person could be rated as 70% worth. On the other hand, a comprehensive analysis with an accurate details could represent a category level of, for example, 90%. This 90% value should be correct in nine cases out of ten cases. (Berkun 2006, 43.)

A snowball effect can be spotted especially in the scheduling and it is easily underestimated in projects. A multiplier impact effects to an individual events, and that yields to a cumulative probability. If the first deadline is complied with 90% probability, and the second deadline is defined to be complied also with the same 90% probability, at this point the probability to maintain the original schedule is actually only 81% in the second phase. The probability of being late is constantly increasing if the deadlines are followed with, for example, only 90%. (Berkun 2006, 46-47.) Therefore, to avoid the snowball effect, there should always be some slack in the project tasks. Too tight schedule is difficult to maintain, if every part is constantly pushed to its maximum.

For minimizing the risks in the schedules, a large schedules should be divided into a smaller pieces, so that there are more changes to make checks (Berkun 2006, 50). The checks help to prevent the problems already in the early stages. A smaller legs are easier to accomplish than a large entities or a long time periods. Thus, a checklist is a handy tool when analyzing the status of a project.

### 4.1.3 Importance of a team

A project can be resistant to the problems if the team members trusts to the team. If the team has succeeded well previously, the team members are feeling confident and do not panic that easily. They also have more patience and self-confidence. (Berkun 2006, 321.) The team members can work more efficiently if they do not have to stress about the team dynamics and the cooperation skills of the team. An existing teams already trusts to the others, and therefore a success is easier to accomplish in a long term.

No matter how skillful and knowledgeable the project manager is, he/she is completely dependent on the relations to the team members. The project manager must be able to reassert the value of each team member, that they can perform their tasks efficiently. (Berkun 2006, 235.) Rewarding the team members when they have performed well can increase their commitment to the project. At least giving a positive feedback occasionally, drastically raises the spirit of the team.

### 4.1.4 Meetings

There are always meetings in projects, whether the participants wanted it or not. A technology helps to decrease an unnecessary travelling to the mandatory meetings. The persons can participate to the meeting for example with skype.

An unimportant meetings should be left away. The meeting becomes more important if the participants are receiving and changing an information that is difficult to get from elsewhere. (Berkun 2006, 262.) Instead of conversating a daily political topics, or something other non-relating to the project, the meetings can be more efficient with a clear agenda. There is no point of wasting the valuable time from the participants, if the whole meeting does not add any value to their work. At least some new information should be received, or some problem being solved together.

The meetings are successful only if at least one of the participants knows how to facilitate. It can be done by the one person only or then all can do it. Some persons are a natural talents in this, and it can make the meetings significantly quicker and smoother. The facilitation means that someone is guiding the conversation and making it more efficient by focusing to the correct issues. (Berkun 2006, 263.)

The meetings can be divided into a three categories based on its intensity:

1. strongly interactive conversation,
2. reporting or an average conversation and
3. a situation- and a project report. (Berkun 2006, 266.)

In the interactive conversation, all of the participants are involved in the conversation and sharing their ideas. This often reveals completely new points of views, that are valuable for the sake of a successful project.

## 4.2 Project management

***We are not interested in monitoring a specific matter, before it has caused us a trouble at least once. (Berkun 2006, 45).***

Scott Berkun (2006) defines project management as an objective to increase a possibility of a positive result by every which way available, and a quick accomplishment. (21.) The projects can lead to the good results in many ways. Some of the projects are successful in the short term, and others in the long term. An economic benefits can be bad but simultaneously if the company has gained a new strategic partners and new customers, then the results can be positive in the long term.

A challenge in the project management is not only to achieve the correct direction, but to maintain it (Berkun 2006, 86). Even the simplest instructions are sometimes forgotten. The project management and a human behavior are linked together. During the long projects the objectives can sometimes be forgotten, and a staff may need an education also during the project because new team members can join the project during it.

A leadership skills are required in a good management, and a management skills are required in a good leadership. A difference between these is narrow, and these both are included in the project management. (Berkun 2006, 16.) According to Virtanen (2009, 78), the leadership focuses to leading people and the management manages matters.

### 4.2.1 Decision making

Decisions are made daily in the projects. Some of these are important and some are not. It can be occasionally difficult to prioritize the tasks. Deadlines are part of the projects, they are forcing the management to make decisions, whether it is a good one or a bad one, it must be made. The project management must be able to tolerate the stress and the pressure very well. The pressure means compelling and a limiting factor or a force (Berkun 2006, 292).

That the decision making is possible after all, it should be clear to all who makes the final decision. As a rule of thumb, the greater the pressure and contributions in a project, the clearer it should be who has the authority to make decisions (Berkun 2006, 291).

Some persons have an ability to make decisions efficiently, and therefore they can get more things done. The work should be divided into meaningful pieces, and important decisions and actions should be identified, and the time should be spent with these. In the decision making, there are four factors which can be utilized: experience, instinct, education and colleagues. (Berkun 2006, 196-197.)

Identifying the correct decision is fairly easy for most of the people, but it is a small group who has courage to actually make the decision and stand behind it to the end. Some persons are always criticizing these decision makers, but often they do not have the courage to take the responsibility by themselves and tolerate the pressure. (Berkun 2006, 214.) Some decisions are always those, where all options are bad from someone's point of view. However, the choice must be made. It is difficult to please everyone, and a manager has to balance between rationally correct choices and keeping the staff satisfied. Sometimes it may be necessary to select the "wrong" option, if it has significantly important role of keeping some crucial person or subcontractor happy. It is not worth it to sacrifice a vital link caused by only a minor disagreement in some unimportant matter. The reason for the disagreement can be for example an offer, which seems to be relatively high and above some other, that otherwise trustworthy subcontractor has given. Therefore, in this particular case it may be the best to accept the price, even if it would be a little bit higher than someone else's. In the long term, this decision can be beneficial in the future.

Management should spend their time wisely, and therefore prioritizing everything is important. A manager must be able to take distance to matters and to think from the wider perspective. Deciding which decisions are important is an important skill (Berkun 2006, 221).

### 4.2.2 Communication

A communication with electronic devices contains five levels; sent, received, understood, agreed and turned into useful actions, and communication is only possible if third level (understanding) is achieved. (Berkun 2006, 229.) It is important to observe that is not enough that the message is sent, the receiver needs time to read it and act upon it. The sender cannot assume that the message is read in the first place and a content of it is now clear to all persons involved. The content must be understood properly that the reader can form his/her opinion and reply to the message. Even when the receiver replies and agrees with the sender, it does not guarantee that any useful actions are made after a consensus is reached.

In a project management an email is the primary method used for communication. A project manager can encourage others to write clear ideas and definite questions by doing so himself/herself. One good answer to the email conversation can help the whole organization to understand unclear issue. On the other hand, an implicit email with confusing ideas can make harm to the project manager and for the whole project. (Berkun 2006, 255.) Showing example is actually one of the primary responsibilities of the project manager. Using concise answers and questions makes the conversation faster than writing too long e-mail messages where can be even too much information and unimportant details.

## 4.3 Project management tools

Project management tools are invented to help illustrating the progress or a process in a clear, understandable manner. These tools are extremely useful for the managers especially in meetings with other persons. Charts and diagrams are aiming for a plain and an unequivocal way to demonstrate the durations and the sequence of the activities for all the participants in the project. Other team members can catch the main idea much faster with pictures and colors instead of telling the facts only by using words. Visualization helps to share the goals for others.

### 4.3.1 Gantt chart

A Gantt chart is a line chart which helps to illustrate where a certain activity settles in a project. It helps to demonstrate the starting and the ending of each task in a bigger complex in a way that every participant understands it. In the bigger projects, the Gantt chart can simplify the general progress of a project to larger parts. Details are left away that the main phases distinguish better. (Mäntyneva 2016, 73.)

The progress can be illustrated in days, weeks or months, depending from the duration of the project. The tasks are listed one below another, and listing helps to identifying all the individual tasks. Figure 7 below shows one simplified example how the Gantt chart can look. A timeline is in upper part of the chart and the tasks are listed in left.

The Gantt chart is attributed to an American mechanical engineer Henry Laurence Gantt, and it is widely recognized that the Henry Gantt invented it in the 1910. But in fact, it was actually been invented by a Polish engineer Karol Adamiecki already in the 1896. (Réveillac 2017, 116.)

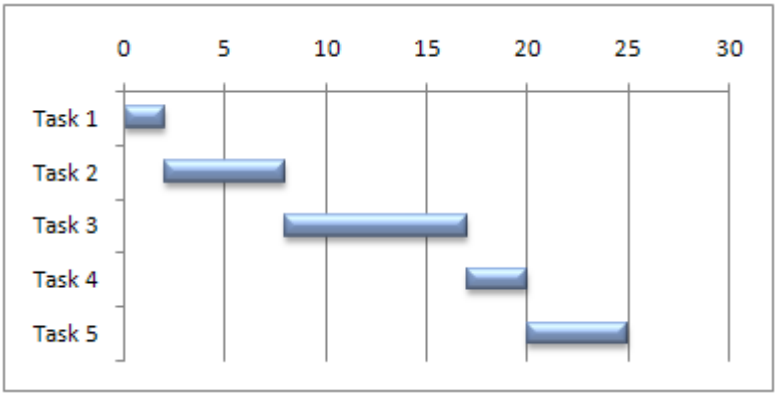



Figure 7. Gantt chart. (Microsoft)

### 4.3.2 Critical path

A critical path illustrates the shortest possible duration of a project. It demonstrates which activities are essential to perform on time in a project. These activities are organized sequentially in the correct order. The activities in the path are assumed to

perform on schedule, or otherwise the whole project will be late. Some of the activities can be finished earlier or later than previously scheduled, and this has an impact to the project's date of completion. If some activities are falling behind, the project manager has a possibility to add resources to these ones. The project manager can reorganize the activities to be conducted in parallel instead of sequentially if it helps with maintaining the original schedule. (Mäntyneva 2016, 70-71.)

Some of the activities can be done simultaneously, but most of the activities cannot. The critical path starts from the first activity which needs to be done right in the beginning. It follows with the second activity which requires that the first one is done before. The critical path is formed in this way, and it illustrates very clearly what is the correct order for the activities in the project. The path helps to prioritizing the activities according to the defined schedule.

Scott Berkun (2006) defines the critical path as a group of activities, which leads to the fastest ending time of a project. In the critical path analysis, the dependency of each task is considered compared to others, and the links between tasks are determined. A chart is created based on input, for example, a flow chart or a diagram. A bottlenecks can be recognized already in this phase, assuming that the chart is made properly. Designing and prioritizing each activity is a responsibility of a project manager. The critical path helps to make sure that the most important tasks with the highest priority are not in danger. The project can be delayed for several reasons, one root cause is often the lack of a tiny component, which is not very significant itself, but critical because some other tasks is dependent from it. (344.)

The critical path analysis can be utilized also when important decisions or actions are needed to resolve that the project can continue without interruptions. According to Berkun (2006), there is a critical path for all the situations happening under a higher level. A bottlenecks and a critical points can be spotted also without making any charts or other illustrations when problems are examined as a group of matters linked to others. A focus should always be directly in parts, factors and decisions which are actually vital from the progress point of view. This way resources can be utilized better and a team can be pushed forwards significantly. (344.)

Typically, unexpected things occur during the project, regardless of careful planning and scheduling. Some tasks might take more time than previously assumed or calculated, and then the project manager must make quick decisions. There is always a possibility to work overtime for example if only one or two shifts have been in use up to the present. Of course, in this case the budget of the project must be carefully taken into consideration. Working overtime increases total costs, and it must be decided whether it is better to increase total costs because of increased labor costs for example or is it really that critical to maintain to original date of completion. There can be a penalty from delay, and usually the size of it depends from the size of the actual project.

How to overcome challenges in a critical path of decision making? A project manager can be extremely busy and contacting this person is not always so easy. The responsibilities and decisions are poured to him/her, but other persons around could have been able to solve some issue by himself/herself. How to divide workload more evenly? Scott Berkun (2006) states that one method is to devolve power between a team. It is best to let others to make decisions and use their own judgement when consensus is needed. The extra bureaucracy can be avoided if only the most important documents, certificates and forms are required to be signed by the project manager. In fact, critical paths can be made to more efficient by removing processes and devolving power inside the team. By focusing to critical path, less important things are easier to handle and are solved with less efforts. (345.) Minor details can actually solve naturally when something more important issues are being solved. If all the concentration is focused to something unimportant, a team can easily waste time without even knowing it during that time.

### 4.3.3 Precedence diagram

An interrelationship between activities can be shown with a precedence diagram. The activities are linked together inside a network and the activities are typically named with one single letter or number so that the diagram can be kept simple even with large amount of information. The durations are shown inside each activity box, so that the timeline can be seen and analyzed from the diagram (See Figure 8). A dummy activities are also eliminated because the durations are marked to the

activity boxes. The earliest start, earliest finish, latest start and latest finish are marked in the precedence diagrams. So called total float is calculated from the difference between earliest and latest finish dates. In practice, latest finish minus earliest finish. Even completion percentages can be marked in precedence diagrams for indicating how well certain activity is progressing and when it is possible to start the next activity (See Figure 9). This is typically done with ten percent accuracy. (Lester, 2007, 125-126.)

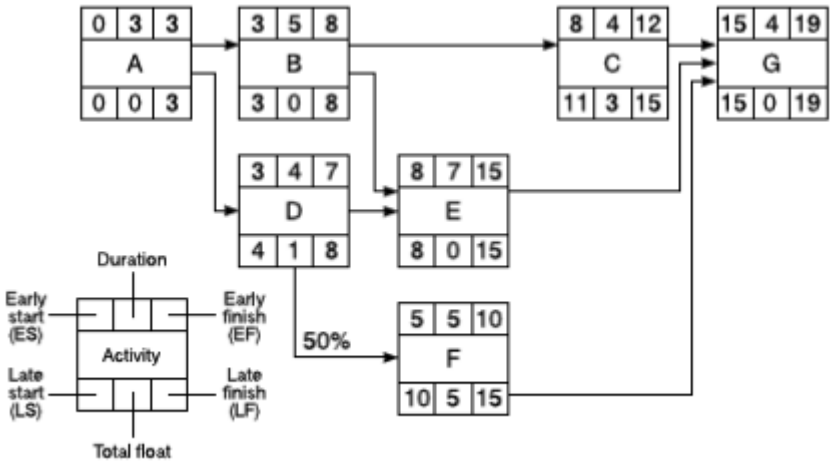



Figure 8. Precedence diagram. (Lester 2007, 126)

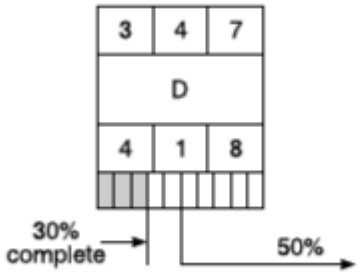



Figure 9. Precedence diagram, completion in percentages. (Lester 2007, 127)

Because the earliest start and finish dates are written in the precedence diagrams, therefore it is relatively easy to analyze the dependencies between the activities and define the critical path of the project. The precedence diagram can be very informative when it is applied to a project.

### 4.3.4 Value stream mapping (VSM)

The value stream mapping (VSM) is a lean manufacturing technique used for illustrating the flow of materials and information. By analyzing the value streams, it is possible to identify the bottlenecks and the activities which does not add value to the process or to the product. What is interesting when analyzing value streams is that the mapping can be utilized also in sharing knowledge and information, not only for assembly lines making physical products. The value stream mapping can be used for identifying where information is not flowing smoothly and that creates bottleneck. Handoffs or other waiting times between team members can yield to unwanted waste inside the process. Communication and collaboration skills can be improved by analyzing the current situation with the help of a value stream map. A standard symbols are used with this method. (Mukherjee)

The value stream mapping is invented by Toyota in the 1950. It became more popular after Peter Hines and Nick Rich published an article "The Seven Value Stream Mapping Tools" in 1997. The value stream mapping is used in processes for determining any obstacles which are blocking the flow in stream. By drawing the value stream map, it is easier to understand the overall situation in bigger scale. It does not focus to only an individual activities but instead it illustrates the whole chain of activities and parties, including work in progress. Each activity is linked to a production management and to other activities. Any shortages in equipment or in safety can be spotted from the map. The value stream mapping is useful tool when correctly formed but “future map” or “optimal state map” can also take too much time to create if it is not fully clear how the process works. Therefore, the mapping usually starts by creating the value stream map based on current situation and after that development is made where it is possible and needed. (Väisänen 2013)

### 4.3.5 Theory of constraints (TOC)

The theory of constraints (TOC) is a method invented by Eliyahu Goldratt. It is used for management purposes to understand and measure how well certain chain of activities works when these are linked together. The basic idea behind the theory of constraints is that a company has input, and output and the process is between these

two phases, which is a chain of necessary activities. The input is the raw material delivered by suppliers and the output is the final product or a service. The performance of the process is dependent from its sections or components, which can be for example subcontractors, workstations, workers or even a specific machine or a software used for enterprise resource planning. The limiting factor in the chain of activities is the weakest link which determines the actual flow through the process. The weakest link sets the phase for the other activities, and if more material flow is needed, the best alternative is to add resources to this weakest part. (Pirasteh & Fox 2010, 39-40.)

### 4.3.6 Program evaluation and review technique (PERT)

The program evaluation and review technique (PERT) is a tool invented for making better time estimations by analyzing the probabilities of durations of tasks. It belongs to the network analysis methods -group, and it is an important tool for a project manager. The program evaluation and review technique produces time estimates based on several categories: optimistic duration, probable duration and pessimistic duration. It calculates the probabilities of each time estimations. PERT-method is developed by United States Navy in the 1950s for improving the confidence of implementation and following the schedule in projects aiming for missile tests. (Virtanen 2009, 168-169.)

### 4.3.7 Work breakdown structure (WBS)

There are three essential questions which needs to be answered in the work breakdown structure; what the objectives of the project in each phase are, whose responsibility it is to do it and how much time and other resources there are available for execution. The work breakdown structure should be done carefully when starting a project because it helps to understand the dependencies between activities, and the project in its entirety. A guiding project plan is formed as an output from the work breakdown structure. It reveals durations, needed resources and significance of each task inside the project. (Virtanen 2009, 167.)

## 4.4 Project manager

***Things go wrong despite what you do (Berkun 2006, 303).***

### 4.4.1 The role of a project manager

Every team should have one member who is monitoring and driving others forwards and pushing them towards a collective goal. If there is not any project manager, the team can be misdirected caused by personal preferences of the team members. (Berkun 2006, 10.) The project manager is guiding others and speaks behalf of the team in important meetings concerning the project. Reporting and communicating with higher levels of management is also the project managers responsibility.

Identifying a problem is fairly easy but finding a solution and execution of it is much more difficult. It is so much easier to give up or accept only partial solution. The project manager can only be successful if he/she is not willing to give up easily, instead, the project manager should solve the problem aggressively when others cannot. (Berkun 2006, 346.) Freezing in difficult situation is an unwanted feature for the project manager. The problems requires quick corrective actions, and the whole staff is waiting for additional instructions when problems occur suddenly.

A project can fail in many ways if there is not enough motivation to solve every problem without giving up. A good project manager is the force which drives the whole project to success. (Berkun 2006, 348.) Without a strong leader the team can spend their time to something unimportant instead of working with something more meaningful that needs attention currently. There are numerous tasks which has to be done and identifying the most important ones is not always that easy. Berkun (2006, 355) states that prioritizing things and leading the team executing these things is the main part of being a project manager.

### 4.4.2 Responsibilities of a project manager

A project manager has to be able to manage many moving parts and think a project as a totality. The manager can be successful if he/she has knowhow from many different fields. The knowledge creates power, and the manager can earn his/her reputation by knowing the answers to the questions he/she is constantly being

asked. Being a traditional engineer and having an understanding about technical details can help significantly. Also, good communication skills are needed especially when working with international team. Ensuring that the human resources is taken into consideration is also a responsibility of the project manager. Projects are aiming for a good economical result, and therefore understanding about business life is required.

On the other hand, every task cannot be done by individual person and therefore a skillful team is needed. But who will select or hire this team? That is yet another dilemma.

Because a project manager is working more than others with many team members, he/she can utilize the number of sources of information and therefore can see the big picture more clearly than others. The project manager can act like an interpreter between other team members who has narrower perspective and more limited information available. (Berkun 2006, 19.)

Figure below shows some of the responsibilities of the project manager (See Figure 10). There can be even more if the scale of the project is enormous.

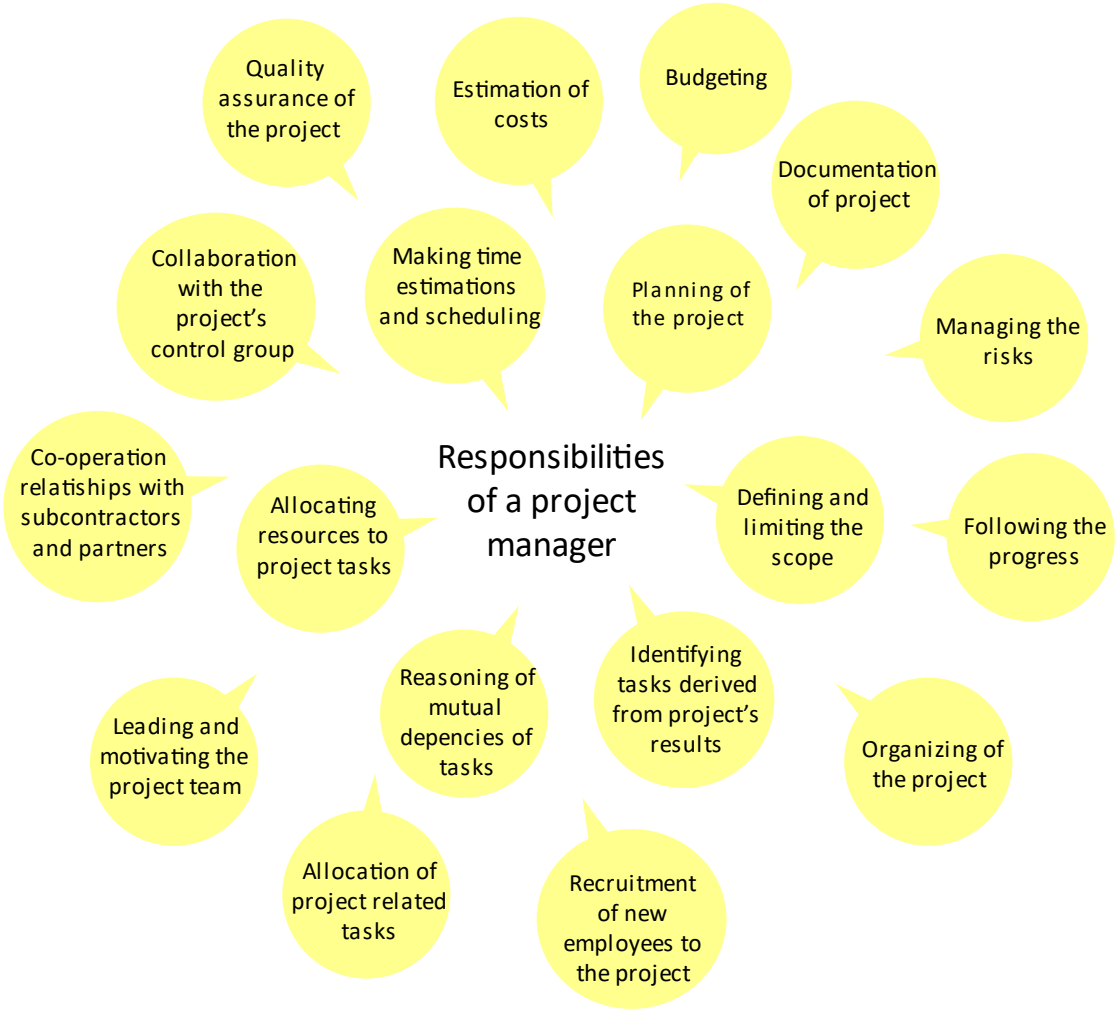



Figure 10. Responsibilities of a project manager. (Adapted from Mäntyneva 2016, 38)

### 4.4.3 Required features of a project manager

Selecting a suitable project manager has a significant influence on the success of a project. The project manager must have an ability to solve problems quickly that the project can continue regardless of some setbacks during the project. A courage is needed that important decisions can be made, and without hesitation.

The project manager should be experienced and should have certain abilities that he/she is suitable for this challenging title. If the project manager is not adequate, the whole project can fail. A competence of the project manager has a great influence on the success of the project. Many of the project managers are experts in their own field, but they do not have experience from managing a project. (Mäntyneva, 2016, 38-39.)

The project manager should know how to motivate others to work in a way that the project requires. Giving support and feedback to the team members encourages them to continue their successful work and gives reasons for their efforts. A trust is a base for building a solid, dynamic work environment. An efficient usage of communication skills helps significantly for leading a group of people. (Mäntyneva, 2016, 39.) From category of communication skills, one of the biggest advantages comes by utilizing many languages. The language skills are a tremendous benefit for a manager. This gives the manager an opportunity to achieve higher position in a large company or in a corporate leading an international project.

## 4.5 Leadership

A good leader should keep his/her promises and mean what he/she says. It is important to admit when one is wrong and consider other opinions and ideas. The leadership can be seen as a practical, simple actions. (Berkun 2006, 208.)

The leader who can take into account that there are three equal perspectives: commercial, technical and customer orientated (See Figure 11), has a competitive advantage compared to others. A project can only be successful in the intersection of these three aspects. (Berkun 2006, 52.) The project manager has a vital role to link these three perspectives together (Berkun 2006, 65).

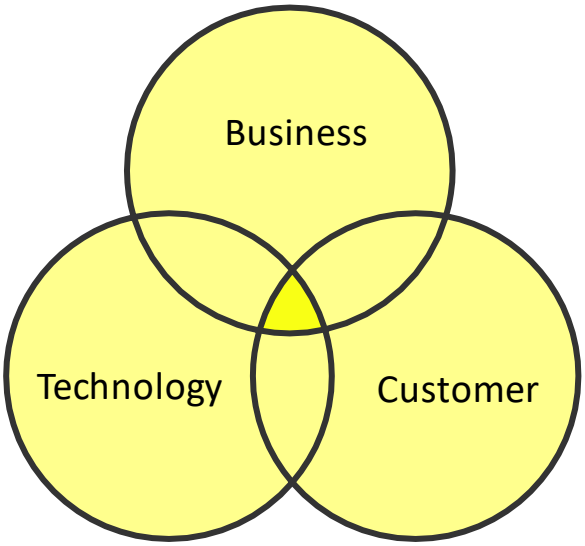



Figure 11. Three perspectives. (Adapted from Berkun 2006, 66)

According to Berkun (2006), a team has limited resources to work, and when an exceptional efforts are made, the team needs time to recover properly. In reality this means that if the first leg is barely achieved using a huge efforts, the second leg starts with an exhausted team which is not yet recovered entirely. A burnout is a serious threat when working with projects. (386.)

### 4.5.1 Power relations

There are two types of functional power: given and deserved. The given power comes from hierarchies and the deserved power is based on actions. (Berkun 2006, 314.)

The power, which is based on information, creates power against others. By being an intelligent and a good problem solver, other persons starts to listen and respect this person's viewpoints. The power can be increased by knowing the certain facts concerning the project, meetings, teams or other persons, because information leads to more accurate overall picture. (Berkun 2006, 426.)

A good leader can give power and responsibilities to an experienced team members who can endure it, but the leader should also offer support (Berkun 2006, 325). The team members can perform surprisingly well under pressure, even in duties which are not familiar to them beforehand, but they should feel that they have an advisor behind them if needed. Every person has their limitations and one person simply cannot know everything from many areas, and therefore asking questions from the manager is the best way to avoid problems caused by general ignorance.

A manager must be able to delegate work to others. It is impossible to do everything by oneself, while other team members might have more capacity to take some extra work. An efficient form of delegation is delegation of decisions or influencing to decisions (Berkun 2006, 319). There are plenty of meetings and subdivisions inside of a large, complex project, therefore it is required to have someone trustworthy to speak on the project managers behalf in some of these meetings.

### 4.5.2 People skills

Interaction is an essential skill for a good project manager. The project manager should not only manage, but also interact with other team members. A basic skills that are needed working in a group of people is an ability to listen and understand different persons, ability to inspire others, ability to communicate clearly both in written and orally, desire and ability to share own knowledge and ability to make correct questions. It is important to realize that all the tasks are dependent from other tasks, and every task is a part of the larger complex, and they all have impact to success. An information sharing should be smooth and seamless. In a project where are many persons involved, they all must work together and think that there is mainly “our job”, instead of only “my job” or “your job”. Every individual worker is just part of the team, and the team can a part of the organization. (Heimonen & Nurmiluoto 2017, 118.)

### 4.5.3 SIMOL-model

SIMOL-abbreviation comes from words Social Identity Model of Organizational Leadership. It is a radical model which differs significantly from traditional leadership models. The leadership is seen as a group phenomenon, and as a result from group processes. The leader is considered as a part of a team instead of stereotypical, traditional leader. The power comes in fact from the group, not from the leader position itself. (Koivisto & Ranta 2019, 42.)

According to Koivisto & Ranta (2019), the social identity model of organizational leadership is based on an idea that we have two identities, a personal identity and a social identity. The personal identity emphasizes our unique properties, which makes us who we are and separates us from others. Our own capabilities and features defines our personal identity, even our hobbies and personal preferences are a part of our personal identity. Instead, the social identity is defined with roles and memberships in certain groups where the person is involved. An environment and a community are forming the social identity. The interaction with other team members and sharing the same goals increases a sense of solidarity, and this group is proud that they are belonging to the group which can accomplish something together. (43.)

By understanding a behavior of a colleague, an employee or other team member, project management can be a slightly easier. A psychology drives our actions and decisions in our subconscious, and a human behavior has an influence also how we can work in stressful projects. The resources and the labor are usually limited, and therefore it is wise to motivate other team members to work in an efficient way.

A leader has a responsibility to reassert the importance and relevance of a group. If the group members feel that they are working with something meaningful, the group can be successful. The group members has chosen the group by themselves, because they feel that it mainly shares the same values and the identity that the member itself. By utilizing a five-step belief circle (See Figure 12), the leader can create a self-fulfilling system which will function as a separate entity. (Koivisto & Ranta 2019, 47-48.)

Figure 12. A five-step belief circle. (Adapted from Koivisto & Ranta 2019, 48)

## 4.6 Checklist

Following and updating checklists is not the main objective itself in a project, but those are used for easier project management and to help in daily operations. Collecting the most critical issues to the one checklist helps to memorize what should be followed currently, and which of the tasks needs the focus and the resources. The checklist can contain only a few matters listed on a post-it note, or then the more advanced version where are lots of information and several subsections under each task. In general, the checklists makes the managers life a lot easier when the important issues can be written down instead of trying to remember everything. A human's memory capacity is relatively unreliably and limited.

By utilizing the checklists, a project manager can get better understanding about the big picture and its phases but by sticking only to the checklist, the manager can be misdirected. A carefully defined processes rarely exist in similar forms, which leads to the certain result every time. The checklist can help during the process, but the checklist itself is not the goal. (Berkun 2006, 16-17.)

Measuring the progress is very important in projects. If the team is big, it is difficult to clearly illustrate the status of the project for everyone. (Berkun 2006, 397.) A checklist can help significantly to illustrate the current progress for everyone who are present in the project meetings. Instead of the project manager only trying to remember what is done, it can be easily shown from the checklist to the others. When the objectives are clear, they are easier to accomplish (Berkun 2006, 337).

During the long projects, measuring the progress can occasionally be difficult. The situations changes rapidly, and a new problems are solved daily. Some minor issues can need a solution in the future, but there might be more crucial matters needed to be solved in the same day. Therefore, some of the problem areas which needs a development work are easily forgotten in projects. Using a brief summary daily, forces the team to handle the current issues instead of postponing those (Berkun 2006, 397).

# 5 The research

The research phases are presented in this chapter. The material was collected inside the Transport Company Ville Silvasti Ltd, and seven persons were selected to be as informants. These seven informants were interviewed, and their answers are shown and analyzed in this chapter.

## 5.1 Interviews

The seven informants were chosen based on their position in the company. They worked in different departments and in different duties so that the perspective would be as wide as possible and that all the issues would be considered from their point of view.

The same ten questions (See Appendix 1) were asked from all of these informants. After these ten questions, there was also a so-called free speech component during which information could also be collected from areas outside the questions. The interviews were structured based on the questions, but the idea was to let the persons speak freely about everything related to the issues at hand, and not to let the questions restrict the conversation too much. However, a theme interview did not seem a suitable option in this case, because the time frame for the study was limited. Moreover, if theme interviews had been used, there might have been too much information, and the conversations would not have been structured so well. In addition, it would have taken much more time to analyze the answers because the author would have had to spend more time firstly to categorize all the answers, so that the research questions could be answered based on the interviews.

In this study, the author wanted to make sure that the interview answers were not censored. This phenomenon can occur if the persons who are answering the questions are afraid to speak freely about issues. Therefore, their identity was hidden, and even their work titles were not used in this thesis because of a risk of identification. This was mainly because there were often only one of each title in the assignor company, Transport Company Ville Silvasti Ltd. By utilizing this method to hide the informants' identify, the author assumed that he would obtain material with

better quality and gain a more relaxed atmosphere during the interviews. These seven informants are marked with numbers from one to seven, and they are mixed in a random order so that they are not in any order based on the title, alphabet or the time of the interview. The numbers were created to point out who the informant was and how many times references were made to one person's statements.

The interviews were conducted in several different forms because all the informants were busy and, because of that, difficult to reach, and most of them did not work in Jyväskylä. Therefore, face-to-face interviews were impossible to conduct in many cases. Only two interviews were conducted face-to-face at Transport Company Ville Silvasti Ltd's office in Jyväskylä, and the other interviews were conducted in Microsoft Skype, Microsoft Teams, by email and by phone.

Table 1. List of informants.

| Title of the informant | Interview date | Interview form |
|---|---|---|
| Chief Executive Officer | 12.10.2019 | Phone call |
| Chief Operating Officer | 20.9.2019 | Face-to-face |
| Project Director | 2.10.2019 | Microsoft Teams |
| Project Manager | 3.10.2019 | Microsoft Teams |
| Site Manager | 1.10.2019 | Microsoft Skype |
| Transport Operator | 20.9.2019 | Face-to-face |
| Truck Driver | 2.10.2019 | Email |

The table above (Table 1) shows which persons were selected from the assignor company. The title of the person is marked as well as date and form of interview. Five different forms of interview were used because the author wanted to make the interviews as easy as possible to the participants, and therefore, the form was chosen mainly based on the informant's preferences. The form of the interview did not matter at all in practice, because the interviews were transcribed in any case into a text form.

## 5.2 Content analysis

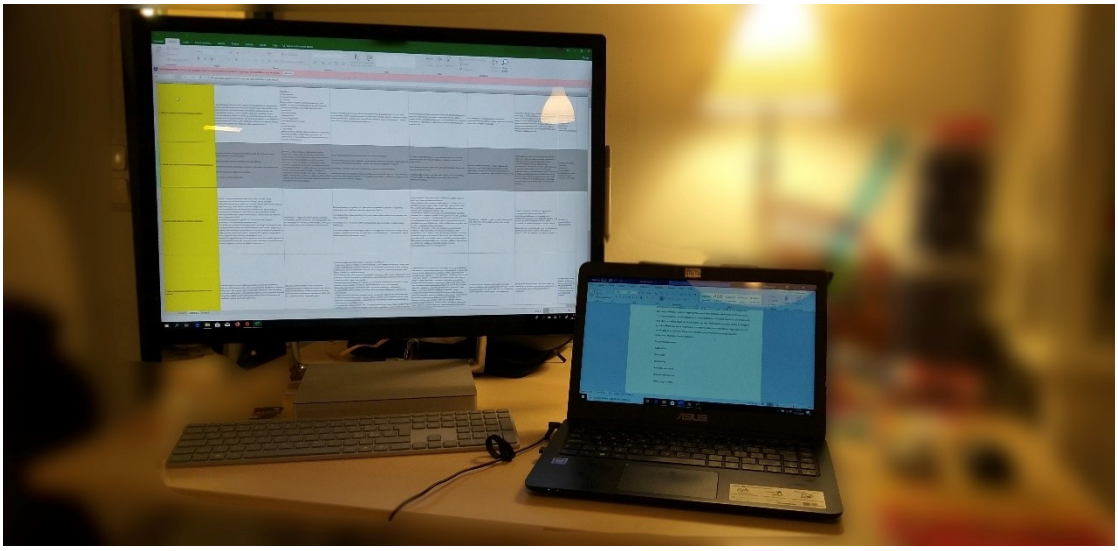
Content analysis was conducted by comparing the answers and gathering the key findings into this chapter. Reliability analysis was also taken into consideration with a

careful documentation of the writing process. Therefore, pictures are attached to this chapter so that reliability can be ensured, and the line of thought can be shown to the reader of this thesis.

Firstly, the interviews were transcribed from the voice recordings to a Microsoft Word text file. Transcribing means converting the recordings into a different form, such as voice recordings, pictures and videos into a text form so that processing and analyzing them is possible manually or with computer software (Kananen 2015, 160). The answers were written manually word for word because the author wanted to collect the information authentically and did not want to lose any key issues or misrepresent the content of the answers.

Secondly, from these text files each answer was summarized into a shorter version, where only the main points were collected. This was done by utilizing the comment function in Microsoft Word. The comments were shown on the right-hand side in a Word document, next to the transcribed text.

Thirdly, all the summarized answers were gathered to a Microsoft Excel spreadsheet, and a matrix was created (See Appendix 2). There were seven informants and ten questions and additionally the eleventh question was the free speech option. Therefore, there were 77 answers which were used as the data for the study. By utilizing two computers in the writing process, the author was able to observe all the answers while writing an analysis based on those. It helped significantly when the answers could be compared at one sight while writing the thesis simultaneously. The picture below shows how the answers were compared in the Excel matrix, while simultaneously writing the content analysis.



Analyzing the answers.

### 5.2.1 What are the biggest problems in completing a wind power project?

*(This chapter is confidential, see Appendix 3.)*

### 5.2.2 Which are the phases in a wind power project, and what factors should be taken into consideration for executing a successful project?

*(This chapter is confidential, see Appendix 4.)*

## 5.3 Early sketches of the checklist

Below are some of the earliest skecthes that the author drew by hand. These were included in this phase that the reader can observe the development work that was behind the final product, which in this case was a checklist for project management.

First sketch (Figure 13) was drawn based on the information given by Informant 7 in paragraph 5.2.2. It is possible to observe the different gategories and their central dependencies between each other in this sketch.

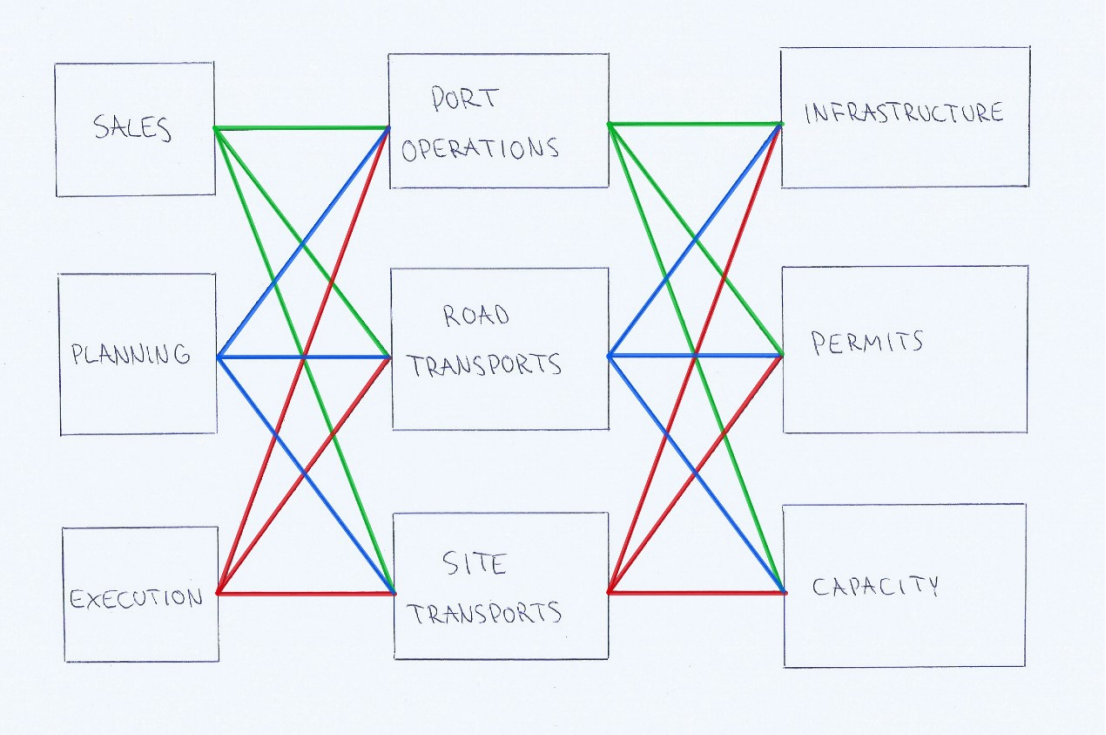



Figure 13. Sketch 1, illustration of dependencies.

The following two figures below represents two different approaches to how a checklist can look like in practise. First one is called a fishbone model and it is based on a horizontal timeline in the middle (See Appendix 5). All the main activities are written in the square boxes. Under each main activity, there are subactivities which belongs to the same category, and these are linked to others one way or another. The name fishbone comes from the arrows which are pointing towards south-west in upper half section, and towards north-west in the lower part of the diagram.

The second figure provides alternative solution for the outfit of the checklist. This model is called a spruce model, and there all of the activities are listed vertically. Idea is to start from the bottom, one can imagine roots of a tree or a project (See Appendix 6).

Contents in these sketches are not 100 percent correct. These were drawn to illustrate the author's thoughts in a visual manner and with more creative point of view in mind. The documentation requirements were also fulfilled with these figures.

# 6 Conclusions

The last one from the three research questions, “What kind of checklist for project management is functional for the Transport Company Ville Silvasti Ltd?), is handled in this chapter. In the previous chapter, a focus was mainly in wind power projects in more abstract level, such as what are the challenges and important issues to be taken into consideration that a project can be conducted successfully. Here the focus is on creating an output based on the research. Concrete product, which in this case was a project management tool, was the output of this bachelor’s thesis.

## 6.1 Central issues

Based on the research, there seemed to be a demand for a user-friendly project management tool. The wind power project logistics is rather complicated field of business with plenty of variables and dependencies. Therefore, monitoring the status of project was considered as difficult occasionally. The variables that changes constantly can be, for example, a schedule or an equipment. The work tasks and the activities are dependent from others, and this creates challenges for scheduling the project. The central issue is to recognize and define these dependencies. The idea of visually illustrating the whole project was considered helpful.

There were strong evidences that the wind power projects have changed drastically during a few years. A pressure to make logistics more efficient is significant, while the components have grown bigger and the site roads are getting worse constantly. The increased component size was a general issue which was mentioned in all of the interviews. Larger and heavier components leads to problems in many areas. Transporting these components is more complicated than ever before. Equipment is pushed at its maximum in many cases while safety should be the priority number one. Specifications of site roads are standardized and defined by the customer, but still customers get approval for site roads from the Transport Company Ville Silvasti Ltd. All the value adding services such as organizing an inspection and test runs to site roads should be profitable to the company. Especially when the risk is considered as relatively high in this case. The safety of the site roads is an important factor for successful wind power project. Accidents should be avoided by any means.

Information sharing was also a key issue in many areas. Common opinion among the informants was that the company should share more information in general. Breaks in naturally flowing information was compared to an invisible separation walls between different departments inside the company. Challenge is that there are lots of data available but what is needed and what is not is the main question in this area. Especially in the beginning of the project the amount of information is relatively high, and it is essential to recognize that what is needed for the next phases. From the data stream, some matter might feel unimportant but in fact is crucial for another phase. The amount of information available was considered as sufficient in higher levels, but this opinion changed significantly in lower levels in hierarchy.

The challenges caused by infrastructure were highlighted multiple times during interviews. An existing infrastructure can make project implementation challenging. Often the case is that the infrastructure is just not designed for the special transports in mind. Especially in remote areas where wind turbine generators are typically built. Furthermore, other society around the project creates boundaries for wind power project logistics. Driving in daylight would be the best option for large and heavy wind turbine component transports, but it usually is not possible. Other traffic must have a right to use roads without significant inconvenience.

What was interesting was the amount of needed resources. It seemed to be occasionally difficult the estimate the exact amount of needed capacity for the projects because there were simply that many variables. The Schedule, route or equipment can change during the project according to the research. In practice, the number of needed vehicles or personnel can differ from the original plan, however the amount of sold resources is defined in the scope. Therefore, it would be critical to identify possible variables, and create a backup operational models that there would be at least rough plan b available. When the critical issues occur, a quick decisions are needed. This yields to ad hoc type of decision making, while more systematic approach to problem solving could lead to better results. Quick decisions can cause significant amount of extra costs, because decisions made in panic are not typically the most sensible economically.

## 6.2 Creation of the checklist

The checklist was created by utilizing the Microsoft Project software. It was widely used in many organizations. Microsoft Project seemed to be a useful tool for planning the activities and the tasks in projects. Some of the Silvasti's clients were also using it in their project management. One of the clients was Siemens, and figure below (See Appendix 7) shows how Siemens utilized the Microsoft Project software in their project management. On the left side, there are activities listed one below another with their durations and the starting and the ending dates. On the right side, there is a Gantt chart which was automatically created based on the activities.

The checklist was created based on multiple different sources. The tasks were defined, and they were given a specific names. After that, the duration was determined for each task by using days and weeks as a time unit. It follows with the starting and the ending times expressed in dates. Finally, that the dependencies could be determined, the predecessors were defined. This way the Microsoft Project software could organize the tasks according to their order based on the predecessors.

The figure below gives a small overview of the checklist where tasks were given names, the durations, the starting and the ending times and the predecessors (See Appendix 8). Subtasks could be indented to create hierarchies so that a list of the subtasks or categories could be hidden.

One of the features which seemed to make the Microsoft Project a good project management tool was the ability to measure the progress of each task. This could be done in percentages. The critical path could also be determined to the Gantt chart view. The tasks that are critical were marked with red color on the right where percentages were marked next to each task. The progress of the tasks could be defined with five different settings: 0%, 25%, 50%, 75% and 100% (See Appendices 9 & 10).

# 7 Discussion

According to Eskelinen & Kansikas (2014), a discussion chapter should be comprehensive and extensive, and the researcher should speak out in this part. In a scientific research, the discussion is the most important chapter with valuable information. In this phase, the researcher can pull together thoughts, and summarize the key findings during the process. A literature review, collected material, analysis based on material and own conclusions can be connected together in discussion chapter. (166.)

**Reliability** of the thesis is discussed in this chapter. The whole research process was handled with a critical assessment, and the results were evaluated. The reliability of the thesis was taken into consideration by careful documentation in every phase. This way the author could explain all the decisions that were done during the writing process. The documentation included all the sources and the forms of them that were used during the research. All the scientific publications such as traditional books, electrical books and articles can be found either from the internet or from a library. Firstly, a regional library called *Keskilibraries* was used for accessing traditional books. Secondly, *ProQuest Ebook Central* was utilized for accessing more information about the topic globally in the forms of electrical publications. A general information about the assignor company, Transport Company Ville Silvasti Ltd is available for anyone in their websites. Also, all the articles which were used as a source material are available in internet for everyone to read.

**Objectivity** of the thesis was an important theme during the research. The author had been working in the assignor company for about one and half years when this bachelor's thesis was published. Therefore, analyzing the objectivity was the most important matter for the author during the whole research process. Generally, understanding the bigger picture from the field of business helped significantly when scientific research was conducted. However, there was a high risk of assuming that the reader understands all the terms and general working methods, so called modus operandi of a company. The wind power project logistics is a special field of business where occurs plenty of general terms and established practices. These were explained in detail to avoid confusion or misunderstanding. Also, the project

management itself might not be familiar to the reader. Therefore, all the main principles of project management were introduced in the theory part. The projects were also explained briefly and matters that are related to a project work.

**Validity** of the thesis can be analyzed by checking that what were the research questions, and what was an outcome of the thesis. Has the author focused to correct issues? And why certain subject matters were discussed, and some were left out completely? It is obvious that it was impossible to include everything related to the topic in a bachelor's thesis. Therefore, only the most essential matters from the author's point of view were included. The assignor company's perspective was analyzed in every phase. Only the most important issues for them were analyzed and studied in this thesis. The timeline was limited and therefore the focus was kept relatively tightly in the topic.

**Error analysis** can be used for examining the decisions that the author made during the thesis. A chain of thought was shown to the reader with a clear structure in the text which was carefully considered. However, because some of the source materials were classified as restricted, they needed to be left away completely. Including restricted material in this thesis was considered as a serious threat to the assignor company. Including some of the materials even to the original version was not a suitable option because it could cause unwanted reactions among the readers. Therefore, even the identity of informants was chosen to be kept in secret that excessive harm is avoided. The error analysis was taken into consideration especially when the author was converting the recorded interviews into transcriptions. In that phase, the author wanted to use a literal transcription that all the audio recordings were written into a text form word for word. By utilizing this method, potential errors were avoided in understanding the interview answer incorrectly. One factor effecting to the error analysis was the language of source books. The author was using publications written in two languages: in English and in Finnish. Because the author is a Finnish person, it was a natural to use also that language when reading the source materials to gain even deeper understanding about the topic compared to reading books with other language.

**Key conclusions** were firstly introduced in chapter 5.2. The most important findings were underlined by author that the reader can easily observe these critical issues.

Later in chapter six, the key conclusions were discussed more deeply. Furthermore, all of the three research questions were answered in chapters five and six. The key conclusions included challenges caused by the infrastructure, the breaks in information flows, the increased component size, the bad condition of site roads and the need of visual tool which illustrates the dependencies of work tasks.

**Novelty value** is relatively challenging to measure in some cases. There are two sides in this matter: firstly, the novelty value for the assignor company, and secondly the novelty value from the scientific point of view. Did this bachelor's thesis bring something completely new to this area, either to logistics in general or to project management? Answer was mainly no; it did not bring completely new inventions or studied areas which were studied never before. The purpose of this thesis was to develop the project management in wind power logistics by creating a user-friendly checklist. The checklist was the output from the research. The final outcome in the long term was challenging to analyze because the development work might continue after the thesis had been published. After all, this bachelor's thesis was all about making improvements for the assignor company. The term *design research* was introduced in the introduction chapter, and like it was mentioned there, the aim was the produce something that benefits the assignor company. In practice, there was a problem which needed to be solved, or a process which could be developed to be working more efficiently.

**Usability of results** is relevant only in this particular case. This bachelor's thesis was conducted by collecting material which was considered important only for this research. All of the seven informants were from the assignor company, Transport Company Ville Silvasti Ltd. Therefore, usability of results is relatively low. The checklist tools can be utilized in general, but the content of this checklist was created to meet the needs of the assignor company alone. On the other hand, the key conclusions from the project management can be utilized also in other fields of businesses. The project management principles are often similar despite the field of business. The decision whether the assignor company wanted to utilize the results or not, was not the author's concern. The usability depended also on if the development work was considered as important in this area of operation.

**Generalisability of results** was considered to be in a low level in this case. Results applied only with this context. The whole research was following a certain guidelines given by the assignor company, and the results were important for this company only. The generalisability is not that relevant in qualitative thesis. The results of this thesis could not be generalized because the data was collected only from the assignor company. Therefore, the key findings were valuable only for Transport Company Ville Silvasti Ltd.

**Topics for future research** was relatively easy to identify. The future research could contain deeper analysis based on the research. Some of the issues were handled only briefly because resources of the author were limited. It would had been better to analyze the critical issues in a deeper level. For example, one method could have been examining the root causes of the issues which were highlighted by the informants. The author wanted to identify these issues and challenges that the checklist was possible to create. The purpose was to collect just enough material that the project management tool was possible to create. The deeper understanding about these issues could be certainly useful.

Furthermore, there are plenty of well written theory about the project management. The future research could focus to project management in different levels of hierarchy, or to develop the equipment needed in wind power project logistics. Technological development of the wind turbines has been significantly rapid and new innovations are needed that transport companies can compete in these markets. An efficient project management is also needed in every company which are utilizing project work in their field of business. Especially in a big companies which states that they are utilizing continuous improvement methods. A zero growth is said to be the end for a company, and that is the reason why development is always needed that the competitive advantages can be maintained. Therefore, there are always demand for case studies improving the current status of companies.

**Comparison to previous research** could be seen in this thesis. The project management theory was utilized because the matters are not that different between different companies. The challenges are always similar in projects. The schedules are tight, the resources are limited and the power relations effects to the group dynamics. There were plenty of scientific research from the field of project

management, from logistics and from wind power. However, the wind power industry was relatively new and therefore there were not that much research from purely project management in wind power project logistics.

The figure below (See Figure 20) shows the general structure how the discussion chapter should be written. By following this structure, all the aspects were taken into consideration and were handled properly. As one can observe from the text above, all the aspects were handled in this discussion chapter. Hereby, the reliability analysis of this bachelor's thesis was conducted scientifically and hence the circle had been completed.

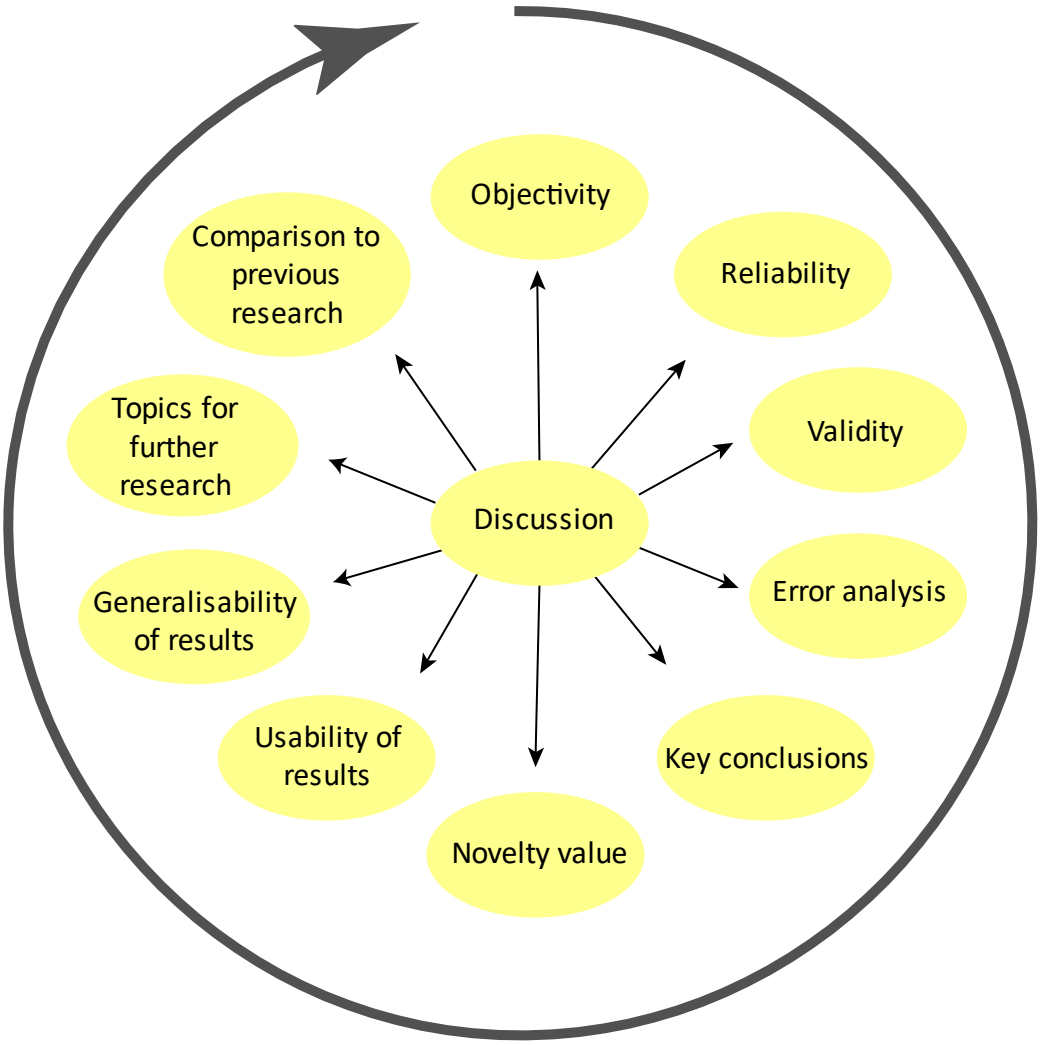



Figure 20. Structure of a discussion chapter. (Adapted from Eskelinen & Karsikas 2014, 167)

Table below summarises all the information sources which were used in this bachelor's thesis. A data inventory table is an useful tool for gathering the information sources into a matrix form that can be shown to the reader (See Table 2). Some of the source materials were strictly restricted and these are exluded from this bachelor's thesis. The restricted materials were mainly supporting the creation of the checklist tool, and were not used as a source for the research itself.

Table 2. Data inventory table.

| Data type | Data source | Quantity | Classification |
|---|---|---|---|
| Interviews | Informants | 7 | Restricted |
| Scientific publications | Traditional books | 13 | Available |
| Scientific publications | E-books | 3 | Available |
| Scientific publications | Articles | 5 | Available |
| Company information | Company web site | 1 | Available |
| Vestas status report/daily coordination MoM, pdf file | Material given by Silvasti | 1 | Restricted |
| Project planning dependencies, excel file | Material given by Silvasti | 1 | Restricted |
| Input list, excel file | Material given by Silvasti | 1 | Restricted |
| Checkliste production, excel file | Material given by Silvasti | 1 | Restricted |
| Siemens project plan, pdf file | Material given by Silvasti | 1 | Restricted |
| Project workshop, pdf file | Material given by Silvasti | 1 | Restricted |

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# Appendices

Appendix 1. Interview questions

1. What different phases does a wind power project contain?
2. What are the biggest challenges in wind power projects?
3. How to overcome those challenges?
4. How are wind power projects changed during past years?
5. How the progress is monitored in wind power projects? Are there any tools available which can be used for monitoring?
6. How the progress could be monitored more easily and more reliably?
7. What factors should be considered in wind power project management?
8. Does the scope and size of the project affect to the project management? If it does, how?
9. Are all the employees familiar with company's defined processes?
10. Are personal and common objectives clear to all participants in wind power projects?
11. Free speech.

Appendix 2. Interview answers matrix (Content restricted. Content analysis figure intentionally left unreadaple that persons can not be identified.)

| Jaunieno vaizdai ar tai, kas jūsų informacijai svarbu. | 2 | 1 | 1 | 2 | 2 | 1 | 2 |
|---|---|---|---|---|---|---|---|
| Klausimas | Chief Executive Officer | Chief Executive Officer | Chief Finance | Chief Finance | Chief Finance | Human Resource | Note |
| 1. Mūsų veiklos kokia tvarumo prasmė? | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 2. Mūsų veiklos vertė tvarumo prasmė? | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 3. Kaip vertinti tvarumo veiklos kitiems? | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 4. Mūsų veiklos poveikis aplinkai ir ekonomikai? Kaip matuojamas? | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 5. Kaip vertinti veiklos tvarumo kitiems? Kaip tai matuojamas? | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 6. Kaip vertinti veiklos tvarumo kitiems? Kaip tai matuojamas? | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 7. Kaip vertinti veiklos tvarumo kitiems? Kaip tai matuojamas? | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 8. Kaip vertinti veiklos tvarumo kitiems? Kaip tai matuojamas? | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 9. Kaip vertinti veiklos tvarumo kitiems? Kaip tai matuojamas? | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 10. Ar tai yra kokia nauja ir kaip ji buvo sukurta? | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 11. Ar tai yra kokia nauja ir kaip ji buvo sukurta? | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 12. Ar tai yra kokia nauja ir kaip ji buvo sukurta? | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| 13. Kaip vertinti tvarumo prasmė? | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

Appendix 3. 5.2.1 What are the biggest problems in completing a wind power project? (Whole chapter is confidential)

Appendix 4. 5.2.2 Which are the phases in a wind power project, and what factors should be taken into consideration for executing a successful project? (Whole chapter is confidential)

Appendix 5. Figure 14. Sketch 2, a fishbone model. (Confidential)

Appendix 6. Figure 15. Sketch 3, a spruce model. (Confidential)

Appendix 7. Figure 16. Microsoft Project example. (Siemens project, 2019) (Confidential)

Appendix 8. Figure 17. The checklist overview. (Confidential)

Appendix 9. (Confidential)

Figure 18. The checklist overview, critical path.

Appendix 10. (Confidential)

Figure 19. The progress is marked with percentages.