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Decision making

Marine Transportation Case

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The purpose of the thesis is to introduce an effective decision-making process and important factors that impact decision making. The thesis also presents some supporting tools for decision making and theoretical background for those tools.

In the practical part, theoretical decision making is applied to a real life marine transportation case. This marine transportation case gives an example of a decision to split scope of work.

As a result of the marine transportation case, by splitting the scope the company which was the owner of the transportation project, gained major cost savings. The company also got a great amount of useful information about the transportation project and decision-making process. The information that they got from this transportation project and this thesis helps them to enhance their processes regarding transportation and decision making.

Keywords	marine transport, decision making, decision making process, split scope of work

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Tämän opinnäytetyön tarkoituksena oli esitellä tehokas päätöksentekoprosessi ja muutamia päätöksentekoon vaikuttavia seikkoja. Opinnäytetyö myös esittelee päätöksenteon työkaluja ja teoriaa näiden työkalujen perusteista.

Päätöksenteon teoriaa on esitetty käytännöllisestä lähtökohdasta merikuljetustapauksessa, jossa myös esitellään kokonaistoimituksen jakaminen pienempiin toimitusosiin, sekä tähän vaikuttaneet lisääntyneet päätöksentekoprosessit.

Merikuljetustapauksen projektin toimitusvastuussa oleva yritys pystyi tekemään merkittäviä säästöjä projektinsa, jakamalla kokonaistoimituksen pienempiin toimitusosiin. Toimitusvastuullinen yritys sai myös kasvatettua tietämystään päätöksenteossa ja kehittämään päätöksentekoprosessiaan merikuljetustapauksen avulla. Tämän opinnäytetyön avulla toimitusvastuullinen yritys

Avainsanat	Merikuljetus, päätöksenteko, päätöksentekoprosessi, kokonaistoimitus jakaminen,

Contents

GLOSSARY

CEO

Chief Executive Officer, top executive of the company and responsible for a company's success (Business Dictionary n.d.)

COG

Centre of gravity

LoLo vessel

Lift-on / Lift-off vessel, vessel cargo is non containerized cargo that must be lifted on and off (Freedom Logistics n.d.).

Part Cargo

Part Cargo means goods or items which do not represent the entire cargo for a ship but whose quantity is sufficient to be carried on the charter terms (France cargo international n.d.).

RFP

Request for Proposal is a document that asks vendors to propose solution for the customer's problem. The RFP document allow vendors to apply creativity and best practices compared to Request for quotation, RFQ, where the customer is already detailed all specifications how the works should be done.

SCM

Supply chain management

Soil Cargo

Soil cargo is usually also called voyage charter or V/C, Contract of carriage in which the charterer pays for the use of a ship's cargo space for one, or sometimes more than one, voyage. Under this type of charter, the shipowner pays all the operating costs of the ship while payment for port and cargo handling charges are the subject of agreement between the parties (France cargo international n.d.).

1 Introduction

Decision-making is a fascinating topic, as all individuals must occasionally make decisions. Some decisions are minor, but some may be of great consequences, and the ability to make correct decisions can lead to either failure or success. Making a correct decision can have a small or enormous impact that can affect an individual, a company, and even the world.

In a Harvard Business Review (HBR) article by Hugh Courtney, Dan Lovallo, and Carmina Clarke, the authors stated that “senior managers are paid to make tough decisions.” Making decisions is not an executive’s sole activity, but it is a very important one. Long-term success often depends on making the correct decisions, and, according to the article, “it’s impossible to eliminate risk from strategic decision making” (Hugh, Lovallo and Clarke 2013).

The importance of decision-making has also been demonstrated in a UK-based study by Capgemini. The study summarized in Figure 1, indicated that senior executives make over 20 important decisions per year. In the study, the average financial impact of each decision was approximately 167,000 GBP (approximately 197,000 euros) and a failure rate of 24%, each senior executive loses approximately 814,000 GBP (approximately 958,000 euros) per year.

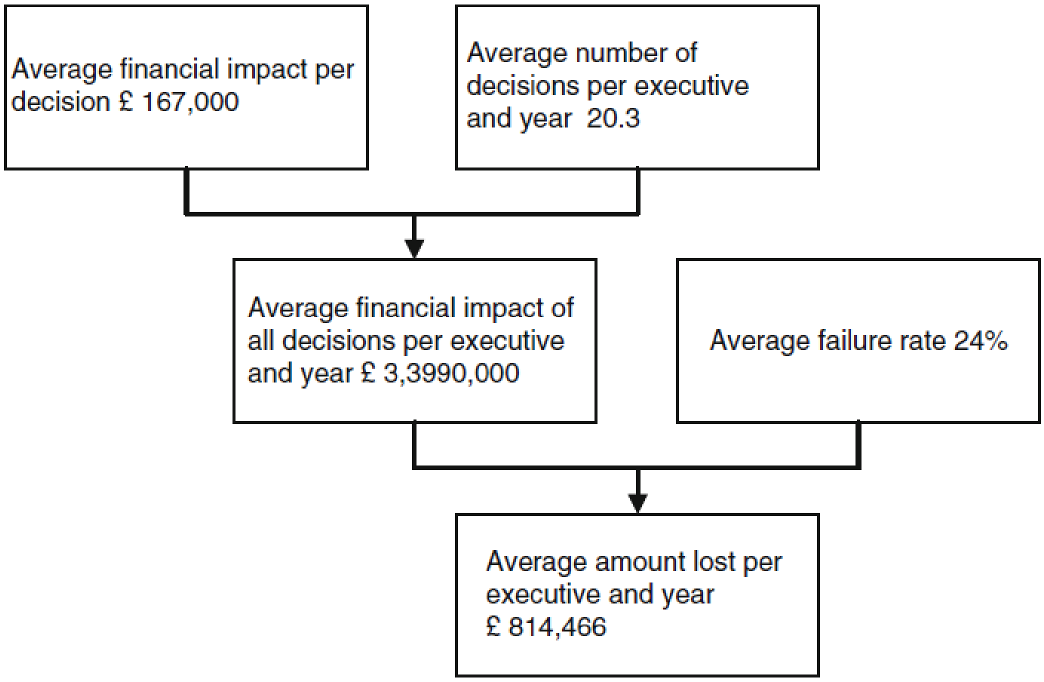

Figure 1. Summary on the Capgemini study (Grünig and Kühn 2013)

The results of Capgemini's study indicate that making correct decisions can lead to significant savings, and executives' decision-making failure rates can be significantly improved. One possibility is to expand executives' arsenal of decision-making support tools and their understanding of which tools work best for given decisions (Hugh, Lovallo and Clarke 2013).

This thesis outlines how decisions were made in a European transportation project in 2018. In this project, decisions were based on the use of various decision tools and a decision diagnosis framework designed by Courtney, Lovallo, and Clarke (2013). The decision diagnosis framework requires that a decision-maker answer questions about the decisions that are to be made. Based on the answers, the framework suggests the tools that should be used for decision-making. The suggestions include conventional capital budgeting tools, quantitative multiple scenario tools, quality scenario analysis, and case-based decision analysis. According to InnovateGov.org, conventional capital budgeting tools stand for such as discounted cash flow, expected rate of return and net present value. Quantitative multiple scenario tools usually involve Monte Carlo methods and decision analysis. Quality scenario analysis involves using representative scenarios and likely consequences, while case-based decision analysis involves using equivalent experience and examples (InnovateGov.org n.d.).

1.1 Background

We live and work in a fast-paced world, and there is a large amount of information available for decision-making. However, not all of this information is relevant to making optimal decisions. In the marine transportation management and shipping industry, which is examined in this thesis, decision-making may present great challenges for typical executives. Usually, small industrial organizations lack a dedicated individual who possesses knowledge of complex shipping issues and is affecting decisions.

1.2 Thesis Aim And Limitations

The aim of this thesis is to provide a brief, general introduction to decision-making as a process and to describe factors and challenges that impact this process. More specifically, this thesis aims to aid decision makers in understanding that it is possible to split the original scope of work into smaller steps and thereby obtain cost savings.

To achieve this aim, theoretical information about the decision-making process was collected from general management magazines and strategic decision-making books. The Internet has also been used as a source of information for the theoretical basis of this thesis. In this thesis, a marine transportation case is used as an example of a project in which the scope of work was split to smaller scopes and cost savings were achieved. The marine transportation case also encompasses the decision-making process and tools for implementing it. In this thesis, conventional tools such as discounted cash flow and expected rate of return are not addressed. In addition, scenario tools such as the Monte Carlo method are not discussed. Conventional tools are not presented this thesis because those generally well known and available at companies, instead this thesis is focusing case based decision making and decision process.

1.3 Thesis Structure

The remainder of this thesis is structured as follows. In Chapter 2, a theoretical framework for decision-making is provided, including the decision-making process and a framework for diagnosing decisions. The decision-making process introduced at the theoretical level is then applied to the transportation case in Chapter 3. Chapter 3 introduces a steel transportation scenario in which two heavy items were transported from Finland to Spain, and the original scope of work was split to smaller scopes. Chapter

3 presents the results of this project and discusses the impact that splitting the scope of the work had on the project budget. Chapter 4 presents the conclusions of this thesis.

2 Theoretical Framework of Decision-Making

Decision-making refers to the actions or processes that are performed for important decisions. Usually, decision-making is a process in which a decision maker selects a logical choice from available options. The options are usually weighted, and different alternatives are considered. A decision maker must be able to forecast the outcome of each option, and based on this information determine which option is best for the given decision. (Business Dictionary n.d.).

According to the Management study guide, “decision-making is an integral part of modern management. Every manager takes hundreds and hundreds of decisions subconsciously or consciously, making it as the key component in the role of a manager" (MSG Management Study Guide n.d.). The ability to make effective decisions is also a leadership skill that earns favor with employers. In extreme cases, poor decisions may have serious consequences, such as losing one's job if the decisions have negative consequences for the company. (Kokemuller n.d.).

Not only managers, but other employees must make decisions on a daily basis. Some decisions are relatively simple and straightforward, such as determining whether a report is ready to be sent to a supervisor. Others are complex, such as determining which proposal to select for a certain task. (Manktelow 2010).

Simple decisions usually require a simple decision-making process. However, difficult or complex decisions typically involve challenges such as uncertainty, in which many of the facts that should be available before the decision can be made are unknown. Complexity signifies that a decision maker has alternatives with many interrelated factors. High-risk consequences signify that the impact of a decision is significant; this affects decision makers in different ways. Some decision makers avoid making decisions because they fear negative results and personal consequences. However, some decision makers embrace decision-making, as it can guide them into leadership roles and endow them with increased responsibilities when opportunities arise. (Manktelow 2010).

When many different alternatives are available, each alternative has its own set of uncertainties and consequences. With an increasing number of alternatives, it becomes far more demanding to select the appropriate one. Considering the above-mentioned challenges, according to Manktelow, "the best way to make a complex decision is to use an effective process. Clear processes usually lead to consistent, high-quality results, and they can improve the quality of almost everything we do" (Manktelow 2010, p. 116).

There are several important factors that have an impact of decision-making, including past experience, age, and individual differences. According to Dietrich, past decisions have an impact on decision-making in that "when something positive results from a decision, people are more likely to decide in a similar way" (Dietrich 2010). For example, individuals are more likely to decide to use the same subcontractor that they have used in the past if the decision has brought positive results. "On the other hand, people tend to avoid repeating past mistakes" (Dietrich 2010); therefore, people usually do not select the same service provider a second time if the quality was not suitable. Because past experience affects decision-making, it is important to understand it when making future decisions. "In financial decision making, highly successful people do not make investment decisions based on past sunk outcomes, rather by examining choices with no regard for past experiences; this approach conflicts with what one may expect" (Dietrich 2010).

Individual differences, such as age and socioeconomic status, may also influence decision-making. Usually, elderly individuals are more confident in their ability to make decisions, which inhibits their ability to adopt new ways of working and making decisions. Individuals with a lower socioeconomic status may have less access to education and resources, which predisposes them to experience negative life events. Usually, these individuals make poorer decisions based on past decisions. (Dietrich 2010).

2.1 Decision-Making Process

Decision-making processes are commonly used in organizations and should also be used for any important decision. Because decision-making is typically a continuous and dynamic activity, the decision-making process is a consultative affair by individuals that have an effect on the organization, and it plays a key role in the functioning of an organization. Usually, the decision-making process has a goal, such as business objectives or company values. To achieve these goals, a company may face various obstacles, such as in the legal and operational domains. These problems are then addressed through a comprehensive decision-making process. Decision sorting usually gives rise to a new problem to solve. That is, when one problem is solved, another arises;

for this reason, the decision-making process is considered continuous and dynamic. (MSG Management Study Guide n.d.).

According to Manktelow (2010), a logical and systematic decision-making process aids in addressing the critical elements that result in an effective decision. By taking an organized approach, one is less likely to miss important factors; in addition, the approach can be built upon to continuously improve decisions (Manktelow 2010). A complex decision-making process is typically time-consuming, and decisions should not be made in a hurry. Naturally, there are additional situations in which rapid decision-making is required. (Manktelow 2010).

Complex decisions should always involve an effective process. In general, a decision-making process involves the following sequential steps:

1. Create a constructive environment and define the goal
2. Gather information and create effective alternatives
3. Weigh the alternatives
4. Select the most suitable option
5. Verify the choice, plan and execute
6. Review the decision and perform follow-up actions

The first step of the decision-making process involves creating a constructive environment and defining the goal. According to Tricia Hussung, “the first step in making the right decision is recognizing the problem or opportunity and deciding to address it. Determine why this decision will make a difference to your customers or fellow employees,” (Hussung 2017). To create a constructive environment for successful decision-making, decision makers should establish the goal and define what they wish to achieve with the decision process. In addition, it is very important to understand the decision process. Understanding includes knowing how the final decision will be made, including whether it will be an individual or team-based decision. There are different ways to develop the decision-making process; one suitable tool for determining how a final decision is made is the Vroom-Yetton model. (Manktelow 2010).

In decision-making, it is important to evaluate all possible alternatives and avoid using the first promising idea that is considered. According to Manktelow, “the more good options you consider, the more comprehensive your final decision will be" (Manktelow

2010). Generating alternatives encourages an individual to be more thorough and examine the problem from different angles. With the mindset that other solutions must exist, one is more likely to make the best possible decision. If there are no reasonable alternatives, then the decision is not very difficult / complex. Many tools exist for generating ideas and alternatives; a common tool is brainstorming. According to brainstorming.co.uk, “brainstorming is a situation where a group of people meet to generate new ideas around specific area of interest," (What is Brainstorming? n.d.). In organizations, brainstorming sessions can be effective spaces for collaboration, and innovative products and cost-cutting services can be born from a single idea.

Brainstorming sessions usually generate many ideas surrounding a topic relatively quickly. With a large bank of ideas to choose from, there is usually a second session to further sort the ideas, weigh the alternatives, and select the best options. There are various ways to arrange brainstorming sessions. Occasionally, it may be effective to invite outsiders with different perspectives to join the sessions to generate new ideas and more out-of-the-box solutions. It should, however, be noted that brainstorming is not always effective. For example, individuals occasionally engage in free riding at brainstorming sessions. In addition, less confident individuals often find that their ideas are declined by other team members. Furthermore, participants can only express a single idea at a time; it is thus preferable to keep a brainstorming team size to approximately six individuals. (Mind Tools n.d.).

With a promising selection of realistic alternatives, the alternatives must be weighed by evaluating the feasibility, risks, and implications of each. Decision-making usually includes some degree of uncertainly, which inevitably leads to risk. Risk can be evaluated by risk analysis; whether the risk is manageable can then be determined. Risk is composed of two parts: the probability of something going wrong, and the consequences if it does. (Manktelow 2010).

Risk analysis is a tool that is used when decision-making involves risk. It helps to identify and understand risk; in addition, it helps to manage risk and minimize its impact. Risk analysis is a useful tool in many different situations. It is primarily used for safety-related issues, but it is also useful in project planning to anticipate possible obstacles, such as human resource problems, supply-chain management (SCM) problems, and market analysis.

The first step in risk analysis is identifying threats. These threats can arise from different sources, such as human resources, illness, or the loss of key individuals. The distribution of supplies can cause SCM problems, which may be caused by natural disasters. Typical project threats also include exceeding the budget, scheduling issues, and quality problems. When threats are identified, the risk must then be estimated, which is performed by calculating both the likelihood of the threats and their possible impact. This calculation can be based on a risk matrix, as an example Figure 2, or real values (risk value = probability x cost of event: 0.2 [probability of threat] x 200,000 euros [cost of event] = 40,000 euros [risk value]). In some cases, the risk is acceptable; however, there are usually ways in which the impact of the risk can be reduced. Impact reduction is usually accomplished with preventive actions, such as health and safety training. Another common method of reducing impact involves increasing error detection, which can be accomplished by cross-checking reports and performing safety testing of products before delivery or release. After carefully performing risk analysis, it is vital that alternatives are validated before any decision is made. The alternatives should be checked against adequate resources, and the financial feasibility of each alternative should be appraised. (Swift, et al. n.d.) Figure 2 below shows a risk matrix example.

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

Figure 2. Risk matrix Example (Examspm n.d.)

Upon evaluating the alternatives, the choice may often be obvious; however, tools may occasionally be required. A decision matrix can be used to evaluate the optimal choice. This matrix is useful when there are many decision factors and each factor’s relative significance must be assessed. Another useful tool is the Delphi technique, which is an excellent evaluation method when group decisions are required. According to Manktelow, the Delphi technique uses multiple cycles of anonymous written discussions and arguments, managed by a facilitator. This approach is beneficial when the opinions of many different experts must be included in the decision-making process. (Manktelow 2010, p. 119).

Once a decision is made, it is important to explain and communicate it to those affected as well as to those involved in its planning and execution. An explanation should be provided regarding how and why the alternative was selected. The more information that is provided and the better the risks and projected benefits are communicated, the more likely individuals are to support the decision. (Manktelow 2010, p. 119)

When the necessary actions are selected, the decision and follow-up actions should be evaluated for effectiveness. This is an often overlooked but important step in the decision-making process. Decision makers should ask themselves what they did well and what can be improved in the future. Everyone can learn their mistakes, occasionally, decisions do not work as planned, and it can be effective to revisit earlier steps and identify better choices. (Hussung 2017).

There are challenges to decision-making, but they can be avoided if they are known and detected in advance. Typical challenges are related to information and the source of the information. For example, information is important, but possessing too much information or insufficient information can pose challenges. Gathering relevant information is thus key when approaching successful decision-making. The source of the information is also very important. For example, relying on only one source of information may lead to misinformation. (Hussung 2017).

Another important part of the decision-making process is understanding its common pitfalls. Executives who make decisions on a daily basis occasionally fall into mental traps and make errors, as discussed below. While these errors are sometimes unavoidable, individuals can learn to understand the mental traps and compensate for them accordingly. Executives who attempt to understand themselves with respect to these pitfalls are able avoid common mistakes more often. (Hammond, Keeney and Raiffa 1998).

According to an HBR article, “when considering a decision, the mind gives disproportionate weight to the first information it receives,” (Hammond, Keeney and Raiffa 1998). The first received piece of information can be as simple and seemingly innocuous as information from a co-worker or a newspaper headline. This trap is called anchoring. In business, one of the most common types of anchoring is a past event. For example, a marketer may project the sales of the coming year based often sales numbers from a previous year. The anchor trap influences not only managers, but decision makers in a wide range of professions. However, decision makers who are aware of the danger of anchors can reduce the impact of anchoring. This impact can be minimized by viewing the problem from different perspectives and alternating the starting point of the problem. It is always better to attempt to solve problems on one's own before consulting with an outside source to avoid becoming anchored by outside ideas. Similarly, to avoid anchoring consultants, one should tell them as little as possible about one's own ideas. Being open-minded and seeking information from a variety of sources is generally effective in preventing anchoring. (Hammond, Keeney and Raiffa 1998).

Another typical trap that decision makers face is called the status quo trap. With this trap, decision makers tend to repeat past decisions because in most cases, this is the safer alternative and has less psychological risk. In business, doing something new generally has more severe consequences than doing nothing; as a result, individuals often retain their existing habits. This problem can be avoided, but it is important to bear in mind that there is no need to reinvent the wheel. One should identify alternatives and use them as counterbalances, remembering to evaluate all pros and cons. In addition, one should avoid exaggerating the effort or cost involved in switching from the status quo. If several superior alternatives are available, one should not default to the status quo simply because of the difficulty in choosing the best alternative. In this case, individuals should force themselves to make a choice. (Hammond, Keeney and Raiffa 1998).

The first step of decision-making is to frame the questions. This is also one of the most dangerous steps. The way a problem is framed can influence the choices to be made, where framing refers to the way in which the questions are presented. Similar questions can be framed in different ways. In a classic experiment by Daniel Kahneman and Amos Tversky, the following scenario was proposed. Three barges have sunk. Each barge holds $200,000 worth of cargo. The salvage options are as follows. Plan A: Saving the cargo of one of the three barges, worth $200,000. Plan B: Having a one-third probability of saving the cargo on all three barges worth $600,000, but with a two-thirds probability of saving nothing. Over 70% chose Plan A, the less risky option, although both options had the same potential outcome. The questions were simply framed differently. To counteract the framing trap, one should not automatically accept the initial framing but should instead attempt to reframe the problem in different ways. This is critical for strategy, as the first step always involves defining the problem correctly. When others recommend decisions, an individual should examine the way the recommendations are framed and propose different frames. (Hammond, Keeney and Raiffa 1998).

In business decision-making, there are rarely no-brainers. Human brains are always working and are occasionally subject to various traps. Complex and important decisions are the most vulnerable to traps, as they tend to involve the largest number of assumptions, estimates, and inputs from a large variety of people. When the stakes are high, the risk of being caught in a psychological trap increases. The best protection against all psychological traps is awareness and action to understand and avoid psychological traps (Hammond, Keeney and Raiffa 1998).

2.2 Framework for Diagnosing Decisions

There are numerous tools to aid in decision-making, and with the appropriate tools, the odds of making an optimal decision increase. The *Diagnosing your Decision* framework presented in Figure 3 is a model designed by Hugh Courtney, Dan Lovallo, and Carmina Clarke. This framework model was proposed in the HBR paper “Deciding How to Decide: A Tool Kit for Executives Making High-Risk Strategic Bets.”

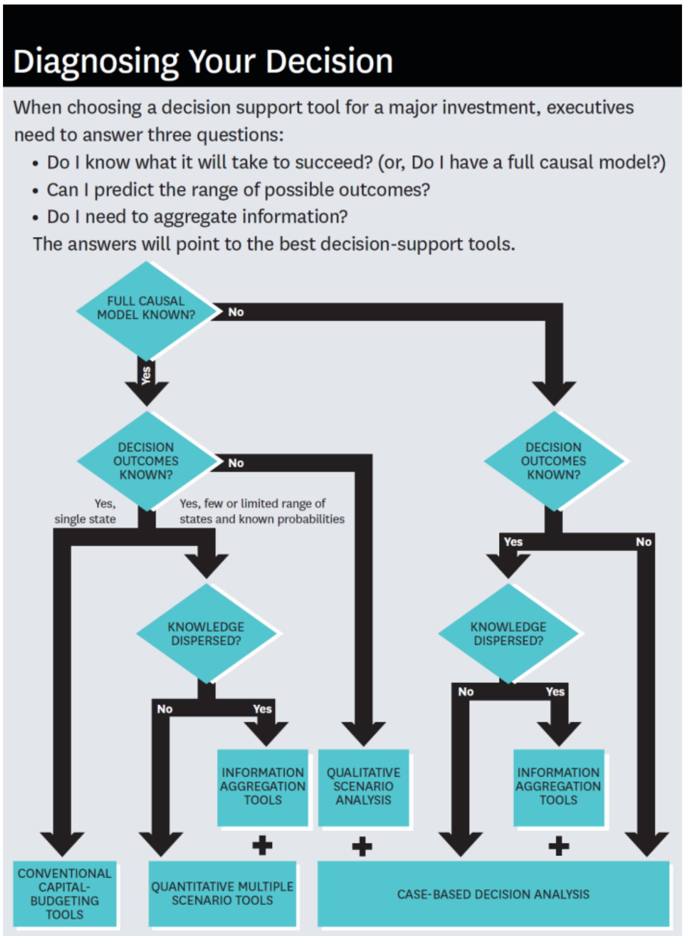

Figure 3. Diagnosing your Decision chart (Hugh, Lovallo and Clarke 2013).

When preparing for a decision, decision makers should identify the most suitable support tool to use for decision-making. To this end, they should determine at least two questions, as follows.

1. What will it take to succeed?

2. How well can one predict the range of possible outcomes?

Typically, executives who make decisions underestimate the uncertainty that they face. There may be internal protocols that hinder the decision-making process, and occasionally executives do not know whether they should use several different tools to analyze a decision or simple budgeting. Sometimes the best choice is to delay a decision until it can be better framed.

Decision makers must determine how well they understand the variables that will determine success. Their answer serves to inform them of whether they have a causal model of their problem. According to the Stanford Encyclopedia of Philosophy, “causal models are mathematical models representing causal relationships within an individual system or population," (Stanford Encyclopedia of Philosophy n.d.). When companies repeatedly make similar decisions, they usually have a strong causal model. A very simple way of testing a causal model is a set of if–then statements. For example, if the weight of a unit is lowered by X%, the price of the unit will be lowered by Y%. When an if–then model can be used, then the decision is causal. For strategic decisions, a clear causal model usually cannot be specified. Companies in the process of developing a new product or technology cannot frame their decision-making process so well that they can claim to have a causal model.

Questions that should be answered for this first step, i.e. what it will take to succeed, are as follows:

- Do you understand what combination of critical success factors will determine whether your decision leads to a successful outcome?

- Do you know what metrics need to be met to ensure success?

- Do you have a precise understanding of (almost a recipe for) how to achieve success?

In choosing the appropriate decision-support tools, one must also know whether it is possible to predict an outcome or a range of outcomes that may result from the decision. Sometimes it is possible to predict a single outcome with reasonable certainty. An example is a company that has made similar decisions in the past, for example, lifting similar items with same lifting plan for many years. In this example, lifting is always performed inside the warehouse, so it is not a weather-dependent process, and the pieces are always lifted the same way. However, under conditions of uncertainty, executives are often unable to specify the range of possible outcomes or their probabilities with a precision that would be required for quantitative scenario tools such as the Monte Carlo method. (Hugh, Lovallo and Clarke 2013).

Questions that should be answered in this second step, how well one can predict the range of possible outcomes, are as follows:

- Can you define the range of outcomes that could result from your decision, both in total and for each critical success factor?

- Can you gauge the probability of each outcome?

Once the first two factors are understood, it is possible to identify which decision support tool is best suited to the circumstances. Depending on the situation, causal model, and ability to predict an outcome, there are different tools that can be used. Conventional capital budgeting tools include discounted cash flow, expected rate of return, and net present value. Quantitative multiple scenario tools include techniques such as Monte Carlo methods, decision analysis, and real options. Qualitative scenario analysis uses representative scenarios and likely consequences, and case-based decision analysis uses equivalent past experiences and examples. (InnovateGov.org n.d.).

2.3 Decision-Making Tools

Because decision-making is often complex and can be influenced by a large number of factors, there is no universal technique for making the correct decision (Lee, Newman and Price, Decision Making in Organisations 1999). Most companies have conventional tools for decision-making, such as formulas for calculating discounted cash flow; in addition, they often use a simple quantitative approach in which an optimal decision can be made based on a mathematical and statistical model. These tools are useful when working in a stable environment and the information is available and well known. (Hugh, Lovallo and Clarke 2013).

The problem faced by executives is not a lack of conventional tools, but the fact that companies use these tools even in highly complex and uncertain contexts. These tools are far less useful in fast-changing or new industries that have new products and an unfamiliar business model. This is because with conventional tools, it is assumed that decision makers have access to remarkably complete and reliable information.

In this thesis, for the Steel Parts Transportation Case examined in Chapter 3, I have chosen to use case-based decision analysis, as the decisions that were made were neither causal nor had known outcomes. In addition, in the transportation case, the executives at Company X had all conventional tools for decision-making; however, these tools were not useful. In addition, in examining this case, I have also used a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis and the Vroom-Yetton model.

A SWOT analysis is a planning tool used to understand the strengths, weaknesses, opportunities, and threats involved in a project or business. It involves specifying the objective of the business or project and identifying the internal and external factors that are supportive or unfavorable in achieving that objective. (SWOT Analysis Made Simple – History, Definition, Tools, Templates & Worksheets n.d.).

Internal analysis is the inclusive evaluation of an internal environment's possible strengths and weaknesses. Factors should be evaluated across the organization in areas including the company's culture and image. Usually, internal analysis examines operational efficiency and capacity, market and financial values, and organization human resources. The SWOT analysis summarizes the internal factors of the company as a list of strengths and weaknesses. Opportunities in a company occur when the external environment changes. Changes can pose a threat to the market position of existing products or services, but they can also facilitate the development of new products or services.

External factors of SWOT analysis are strongly linked to PEST (Political environment, Economic, Social, Technology) analysis. PEST analysis concerns external factors and involves political issues such as law, legislation, and regulations. The economic factors in PEST include taxes and interest rates, while social factors include trends and publicity factors. Technological factors include innovations, licensing, manufacturing, patents, and global communication. Unlike SWOT, PEST analysis considers external macro-environmental factors. (Nishadha n.d.).

The first factor examined by SWOT analysis is strengths. Strengths are advantages, such as positive physical and nonphysical attributes. They are properties of every company and define what a company performs well. Because they are internal factors, they should differ among different departments in the same company. As opposed to opportunities, which are external strengths, strengths in this context are something that can be controlled.

The second factor examined by SWOT is weaknesses. Every organization has weaknesses, which are generally areas in which the organization does not perform well. Weaknesses include the points that can be improved and refer to factors that are within an organization's control that detract from its ability to attain its desired goals. The difference between weaknesses and threats is much like the difference between strengths and opportunities. All companies competing in the same market face the same threats, as those are external factors; however, the weaknesses of each companies are unique, as those are internal factors.

The third factor in SWOT is opportunities. Opportunities refer to the positive aspects of external factors that can provide an organization with a competitive advantage. For example, a reduction in taxes or a change in political climate can provide access to new markets and increase sales.

The final factor in SWOT is threats. Threats are obstacles and risks that a company may face. These factors are beyond a company's control and have the potential to place the entire business at risk. Typical examples of threats include natural disasters, which can affect a company's production or delivery schedules. Companies generally have contingency plans and risk assessment to address threats when they occur.

The Vroom-Yetton model illustrated in Figure 4 is a model developed by Victor Vroom and Philip Yetton that helps to identify the optimal approach and leadership style for decision-making. This model offers several different processes and provides guidance toward the best process for a given situation. For example, if speed and decisiveness are required, it will likely direct one toward an autocratic process. If collaboration is required, then it will direct one toward a more democratic process.

In the Vroom-Yetton model, the following three factors should be considered:

1. Decision quality. Making the correct decision is often critical, and one may need to use many resources (e.g., people, time, information, etc.) to ensure that the action taken has been thoroughly considered and of high quality.
2. Team commitment. Some decisions may have a major impact on the team, while others go unnoticed. When a decision is likely to impact the team, it is best to use a collaborative process. This serves to improve the quality of the decision, and a successful result is likely to be delivered more quickly.

3. Time constraints. When the issue at hand is not time-sensitive, there is more time to research options and include other individuals, which serves to boost the quality of one's decision. If time is limited, however, it may not be feasible to include others or to undertake thorough research.

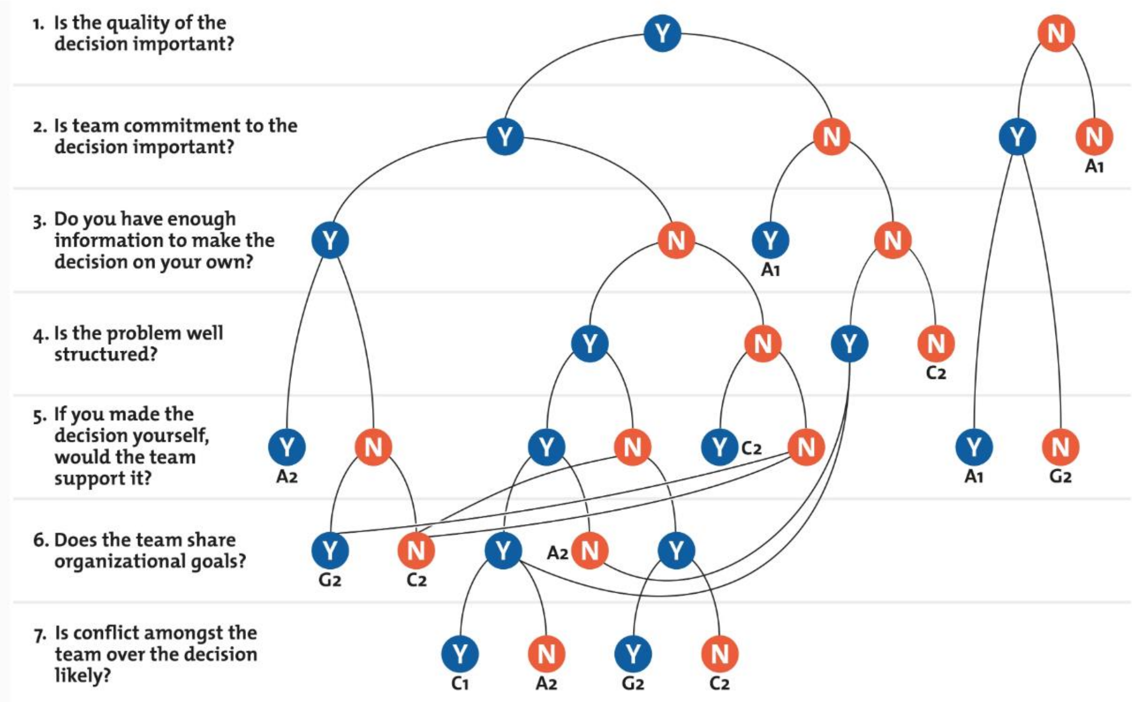

Figure 4. Vroom-Yetton model. The framework poses seven yes/no questions that must be answered to determine the best decision-making process for a given situation. (Swift, et al. n.d.).

The following codes represent the five decision-making processes described by the model.

Autocratic (A1): The decision maker uses the information that s/he already has to make a decision without requiring any further input from the team.

Autocratic (A2): The decision maker consults the team to obtain specific information that s/he needs and then makes the final decision.

Consultative (C1): The decision maker informs the team of the situation and individually asks for members' opinions; however, s/he does not bring the group together for a discussion. The decision maker makes the final decision.

Consultative (C2): The decision maker assembles the team for a group discussion about the issue and obtains their suggestions; however, s/he makes the final decision.

Collaborative (G2): The decision maker works with the team to reach a group consensus. His/her role is mostly facilitative, and s/he helps team members reach a decision that they all agree on.

3 Steel Parts Transportation Case

The steel parts transportation case of this thesis is structured as follows. First, the aim of this case is presented, followed by a general introduction and presentation of the companies involved in the decision-making process. Then, the transported items are introduced, and the original scope of work is defined. Due to the high budget in the proposal phase, cost savings are required for transportation. Savings are achieved by splitting the original scope of work into three smaller decision-making steps. Each of these steps are then analyzed based on the decision-making process. After the transportation from Finland to Spain, the results are discussed.

3.1 Case Introduction

The steel parts transportation case provides a real-life example of the use of the decision-making process introduced in Chapter 2. This chapter also introduces the supporting tools used in the transportation case. These tools include the weighted decision matrix, Vroom-Yetton model, SWOT analysis, and Diagnosing your Decision chart. This transportation case also serves as an example of a project in which the scope of work is split into smaller scopes.

The case described in this chapter is an actual transportation case in which two items were transported from Kotka, Finland to Seville, Spain. The transported items were heavy steel parts, both of which were designed to be suitable for transportation. The scope of the transportation project was to transport the items as economically as possible while addressing any risk-related issues. The original plan of execution was to hire a subcontractor that would handle the entire transportation from Finland to Spain. The initial budget proposals from subcontractors were too high, however, and it was determined that a less expensive means of transportation was required. Due to the high price of the original scope of work, the transportation project was split to three smaller tasks, each of which was subcontracted separately.

In this transportation case, the decision-making steps taken for the new split scope of work are described. The split scope of work began by identifying the most feasible method of transportation. Different methods were analyzed, and a limitation process was used for selecting the most suitable method of transporting the items to their final destination. Because these decisions were complex, a decision-making process was used for each of the three tasks prior to any decisions. The decision diagnosis framework was used to identify the most suitable supporting tools for decision-making.

3.2 Company X

Company X is a company that has operated for seven years but it is still considered a start-up company. The company is heavily funded by investors, as it has not done any positive financial statement so far, and it produces an innovative technology to very conservative markets. The two transported items in the transportation case are part of the turnkey delivery project for Company X. The market value of this delivery project is enormous compared to Company X's annual turnover; thus, completing this project has the potential to open doors for new projects and opportunities. However, failure of this delivery can stop all future projects and investments from investors. This delivery project is thus vital for Company X.

3.3 Company Y

Company Y is a consultancy company that operates primarily in northern Europe. It is owned and operated by four individuals with slightly different skill sets. Company Y generally provides consultancy services to larger companies that lack dedicated employees for special tasks. It has provided lifting calculations and lifting plans, including risk assessment and transportation support, for Company X in the past.

Company Y wished to perform an analysis to better understand who the decision maker was for this case. Because transport was economically a large component of the total delivery project, the final decision would have a large impact on the project results and the future of Company X. The Vroom-Yetton model was used (see Figure 5) to determine who would make the decisions and, if any problems arose during execution, how real time decisions would be made in the field.

The Vroom-Yetton model is based on seven different factors:

1. Decision quality: In this transport case, making the correct decision is critical because the future of Company X is highly dependent on the results of the project, and transportation is a large part of the project.

2. Team commitment: Results of this project has a massive impact of the team's future, as the future of Company X may be jeopardized if the delivery is not successful.

3. Time constraints: The delivery is not very time-sensitive; Company X knew prior to signing the contract that two items needed to be transported.

4. Problem structure: The project is well-structured, and the scope is clear.

5. Team support: The employees of Company X support each other; they are all highly educated professionals and always support the decision maker.

6. Shared goals: The team of Company X share the same goal: successfully completing this project, as that is necessary to secure their future at Company X.

7. Conflict: There is team spirit at Company X; thus, conflict over the decision is very unlikely.

The Vroom-Yetton model was used to answer questions; the selected answers are marked by red circles and highlighted in Figure 5.

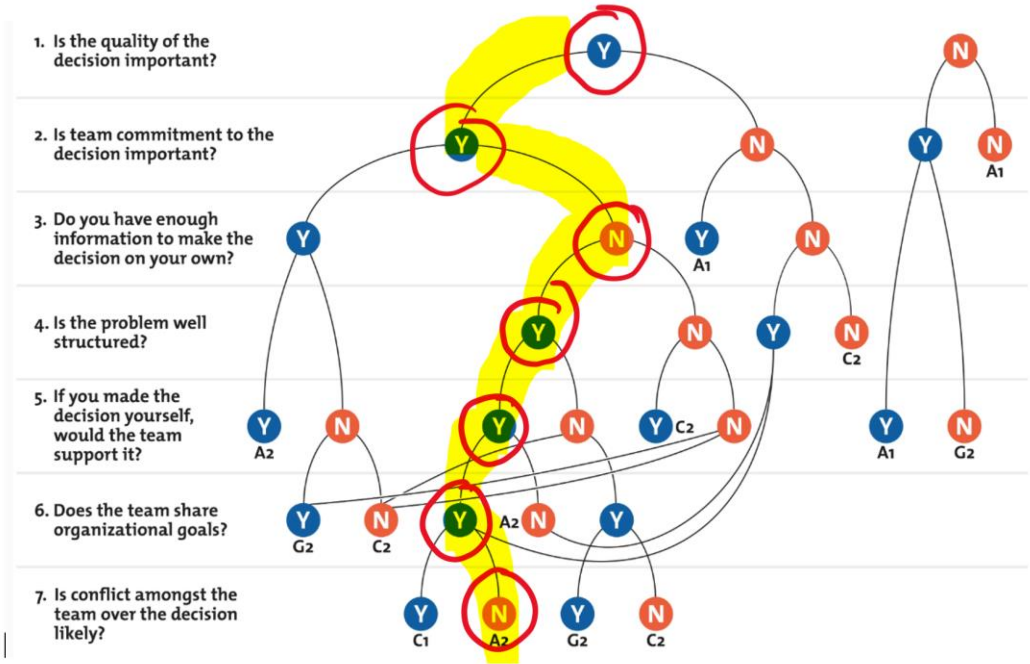

Figure 5. Highlighted and marked decisions using the Vroom-Yetton model framework (Mind Tools n.d.).

Using the Vroom-Yetton model led to the selection of A2, the autocratic decision-making process, in which the decision maker uses the information that s/he already has to make a decision without requiring any further input from the team, as described in Chapter 2.3.

Based on the results of the Vroom-Yetton model, Company Y concluded that the decision would be made primarily by the CEO of Company X. Most of the team members would be used to obtain information, and they would also be provided with information following the decisions.

When members of Company Y introduced the Vroom-Yetton model to Company X, they explained that they had a procuring process that defined who was allowed to make certain purchases, and what the limits were to the contracts that Company X employees were allowed to sign.

The following limits were accepted by the board of directors of Company X:

- Manager-level employees can sign and purchase for a maximum value of 25,000 euros.

- Chief-level employees can sign and purchase for a maximum value of 50,000 euros.

- The CEO can sign and purchase for a maximum value of 100,000 euros.

All contracts or deals involving more than 100,000 euros had to be confirmed by the board of directors.

Company Y explained to the CEO of Company X that the purchase acceptance levels were relatively low for this type of transportation case. Company Y also stated that they could aid in presenting the transportation case as a project to the board of directors of company X and could provide detailed information and support at the meeting, if necessary. Company X was pleased to receive this type of help from Company Y and noted that there would be a person available at each operation site if rapid decisions were necessary. The defined person could also, if necessary, initiate a meeting with the board of directors of Company X. Company Y stated that it could also provide a defined person at the operation sites if necessary in case no human resources were available at Company X.

3.4 Defining the Scope of Work

Transporting two separate items from a warehouse to a shipyard may appear to be a relatively simple task, and it may indeed be very simple, depending on how the work is planned and how much money is available for transportation. The scope of the work in this case is to transport items from Kotka, Finland to Seville, Spain. Figure 6 below shows the geographical location of Kotka, Cadiz and Sevilla Shipyard the points of transportation project.

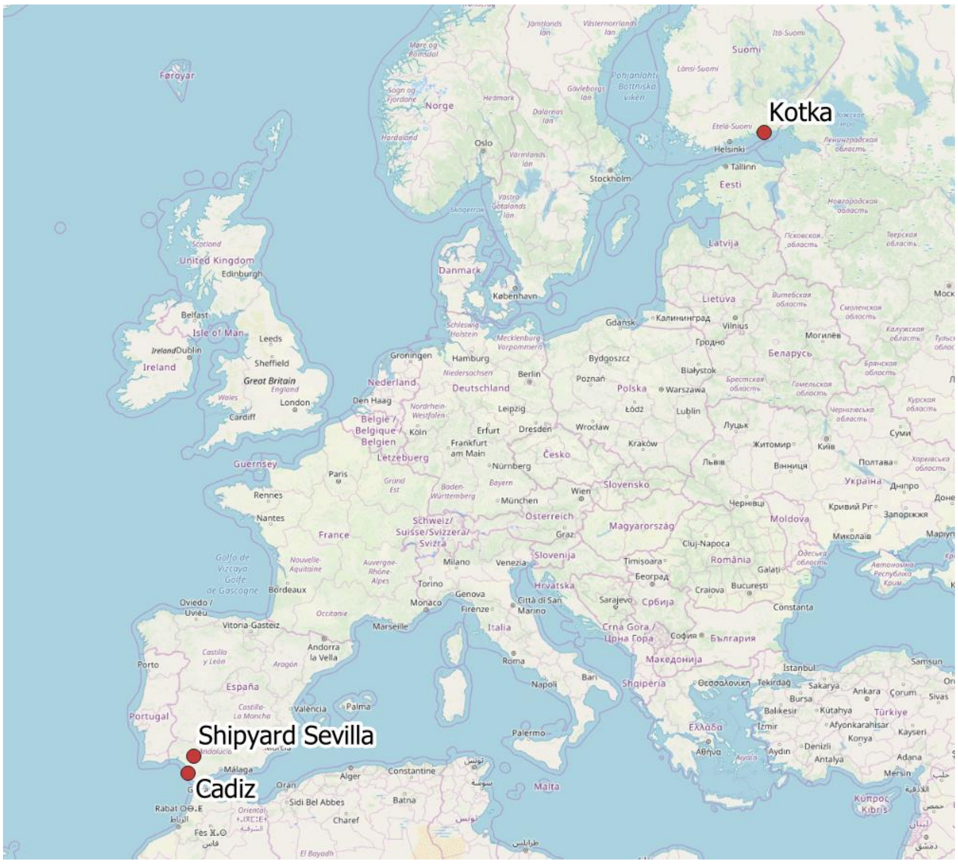

Figure 6. Transportation map.

The goal of the subsequent task of transportation design was to gather information concerning transportation and evaluate all possible alternatives for transportation while avoiding selecting the first promising idea. Company X subcontracted Company Y to gather the relevant information for the request for proposal (RFP) process regarding the items as well as possibilities for transporting the items from Finland to Spain.

With help from Company Y, Company X used brainstorming as a tool for gathering ideas on how to transport the items. Based on brainstorming and the process of information gathering, Company Y developed transportation drawings of the items, as illustrated in Figure 7 and Figure 8, including the lifting point, main dimensions, and center of gravity (COG). Company X also wished for Company Y to obtain quotations and organize the RFP process based on the simplest way to transport the items from Finland to Spain.

Company X subcontracted Company Y for managing the RFP process and verifying and answering questions by the transportation companies, if necessary. The basis of Company X for the process was that the items needed to be transported in the most cost-effective way from Finland to Spain.

The RFP included information on the transportation locations and details of the loading and unloading locations from Kotka, Finland to Seville, Spain. Concerning the transportation RFP, it was important to inform the subcontractor if there were any weather restrictions for the transport. In this case, there were no weather restrictions.

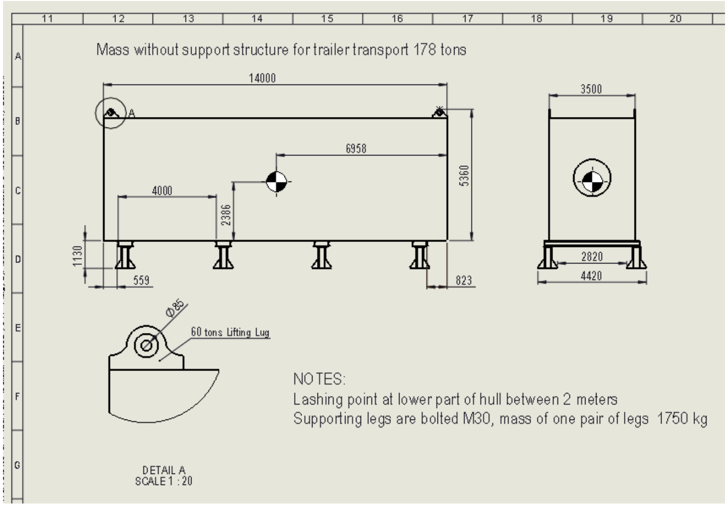

Figure 7. Item 1: Transportation drawing.

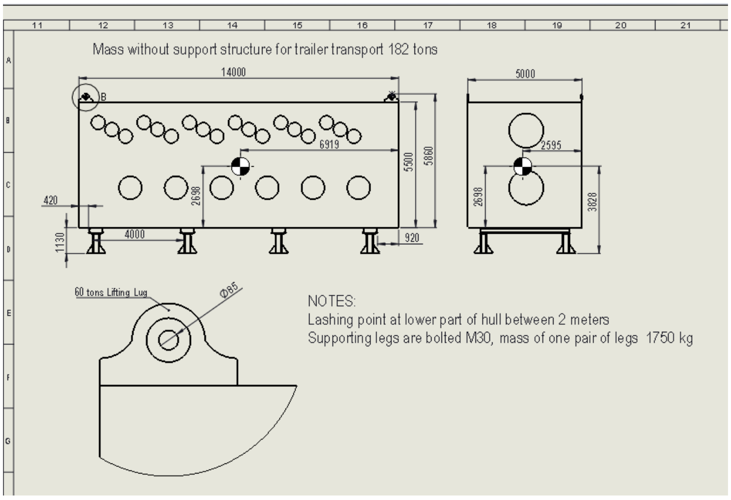

Figure 8. Item 2: Transportation drawing.

The RFP process for this transport was planned to be subcontracted to a logistics company that was capable of transporting the items. There was a clear reason for Company X to use a company that is specialized in the special transportation as a subcontractor. A project involving items of this size was a first for Company X, and the simplest approach involved using a transportation company that could handle the entire operation as a service.

3.5 Project Logistics as a Service

Several special transportation companies are in operation in Scandinavia, and they all provide similar types of services, including project logistics. Project logistics signifies that the company delivers tailored turnkey logistics solutions, which is ideal for a small start-up such as Company X. Company X executives would be able to focus on their own work and allow the transportation company to handle the case. It would also involve a single contract, and the transportation company would be liable for the delivery of the items from Finland to their final destination in Spain.

The RFP process was performed based on the scope of work, the input from the brainstorming process, and the transportation drawings. There were three different companies that offered project logistics. Company Y presented the prices proposed by each company that offered project logistics for the case. All offers received by Company Y were budget offers because there was no set schedule, which would have an influence on the final proposal. All budget offers from the three companies were between 435,000 and 460,000 euros.

Because the budget offers were higher than the acceptance limit of the CEO of Company X, the decision had to be made by the board of directors. The CEO of Company X thus presented the possible ways in which to transport the items from Finland to Spain to the board of directors. The board of directors decided that the proposals were out of the budget for the total project that was sold to the customer in Spain, and that the CEO and other team members had to find alternative solutions for transportation.

Based on a discussion with Company Y, the CEO of Company X understood that transportation could be achieved much more economically, but this would entail multiple contracts with different partners and a significantly larger amount of work.

3.6 Split Scope of Work

Because the board of directors of Company X did not accept the turnkey solution for transport due to the high price, Company X needed to divide the transportation into smaller tasks. Company X understood that they now needed to perform more complex planning for the transportation.

Company X and the subcontracted Company Y began working together and attempted to identify a more cost-effective method of transportation. The scope of the first workshop was to understand the problem in greater detail. Company Y also presented a decision-making tool that they wished to use for the transportation project. This tool was a framework called decision diagnosis. The decision process also had to be clearly documented so that it would aid Company X in the future. Company X and Company Y began having workshops to define the scope of the subtasks. They used brainstorming to create the scopes for smaller transportation tasks and to verify that all possible risks were evaluated.

3.7 Methods of Transport

The first workshop and brainstorming session concerned the possible methods of transportation, as a decision had to be made. At the workshop, Company Y proposed air, road, rail, and ocean transport models as feasible means of transportation. All four of these methods of transportation were deemed feasible when limitations such as the weight and size of the items were not considered.

Air freight is the most recent shipping method. Transporting items via air freight has only existed for approximately one century, and it has both advantages and disadvantages. One advantage of air freight is speed. When cargo must be moved quickly, air freight is the fastest available solution. From China to the US, air freight takes approximately 1–2 days, while the same delivery by sea takes between 1 and 2 months. Air freight is also very reliable in terms of the delivery dates, and almost all carriers provide online tracking. Air freight is also much more secure, and the insurance cost for air freight is usually less than for ocean freight. The largest disadvantage is the cost of transport. Air freight is usually charged by the weight of an item, not the volume, which is usually the case for sea and land freight transportation. Airplanes are relatively small compared to large ships, thus limiting the size and weight of the items to be transported. The world's largest airplane, AN-225, has a capacity of only 250 tons, while the largest container ship, OOCL Hong Kong, has a capacity of 190,000 tons.

Rail transport is a land transportation method that is appropriate for large quantities of goods over long distances. The cost of operations is generally quite low and it is a very safe way of transporting items. Rail transport has very low accident rates and generates less pollution than road transport. In addition, it also avoids traffic congestion. Rail transport has some physical restrictions, as some countries lack rail infrastructure and other countries have different track widths. In rail transport, a track width change necessitates a transfer of goods to a wagon with interchangeable axles; this leads to a loss of time and the generation of extra costs. In addition, goods can only be transported to locations where tracks are present and cannot reach places in which tracks do not exist.

Road freight is a commonly used method of transportation, as roads can transport items to wherever they can be driven. The main advantage of road freight is the ability to transport goods directly from point A to point B. Typically, a truck can arrive directly at a delivery destination. In addition, goods transported by road require less complicated packing than ocean and air transport. However, as for air and rail transportation, there are physical limitations to road transportation. These are usually country-specific, and with special permits, it is possible to transport oversized cargo by road transport. With road transport, there is a greater chance of breakdowns and cargo loss. This type of transportation is not as safe as rail, air, or ocean cargo.

Oceans cover most of the surface of our planet, making shipping an excellent way of transporting items. Throughout the Industrial Age, ocean transport was the sole means of transporting goods in developed countries. As technology progressed, airplanes were used more often for transporting goods. Despite the popularity of air transportation, the demand for ocean transportation has not declined. Ocean transportation is a significantly more cost-effective way of transporting goods compared to air freight. Companies that work with heavy materials, such as industrial parts and machinery, are unable to use air freight because of the weight of the items; even if the weight were acceptable, the price of shipping would not be economically feasible. In addition, ocean transportation is an environmentally friendly method of transportation in comparison to other methods of transportation, if the calculation is based on carbon/transported tons. The largest drawback of ocean freight, however, is the time taken to transport the goods.

Before making any decisions regarding the transportation method, Company Y wished to use the Diagnose your Decision framework presented in Figure 9.

Company Y and Company X proceeded to answer the following questions through the decision diagnosis framework:

1. Do we know what it will take to succeed, and do we have a full causal model?

In this case, a full causal model (i.e., if–then statement) could be used. Company Y compiled a list of different transportation models and verified that they were capable of transporting the required items.

2. Can the range of possible outcomes be predicted?

In this decision, the plan was to verify potential modes of transportation and compare them with each other.

Company X understood that no special calculations were necessary to compare budget prices; thus, they did not require any conventional capital budgeting tools.

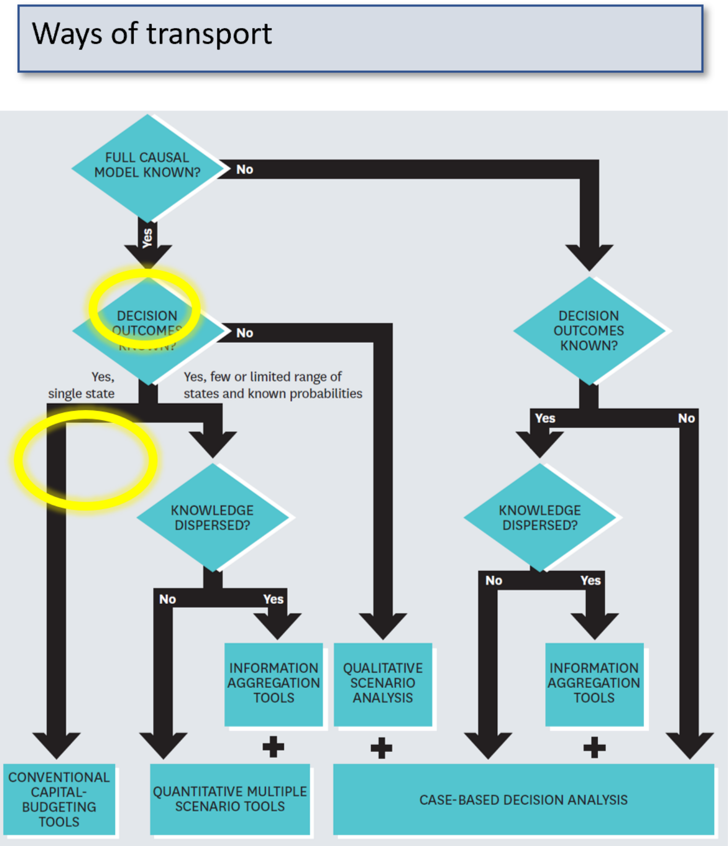

Figure 9. Ways of transport

Based on four different methods of transportation, Company Y verified each method based on the transportation limits for the two items that needed to be transported. Company Y began by checking the air transport limits based on the largest civilian aircraft available in the world. The Antonov An-255 aircraft, the world's largest civilian cargo aircraft (Air Charter service Antonov An-225 n.d.), has a spacious cargo compartment that is 43.32 m long, 6.4 m wide, and 4.4 m high, which allows it to carry heavy cargo with a payload of up to 250 t. Because the cargo hold was too small for the items to be transported and the payload capacity was insufficient for both items simultaneously, the air transport option was eliminated.

Company Y then verified the limits of rail transportation based on the maximum weight of rail transport in Finland, as the items would begin their transportation in Finland. Rail transportation was not suitable based on the weight of the items to be transported, as the Finnish railway company, Valtion Rautatiet, has a maximum payload capacity based on two carriages of less than 97 tons (VR Group n.d.). Thus, the rail transport option was eliminated.

Company Y then verified the limits for road transportation and discovered that there were limits concerning the size and weight in the EU; however, these could be overcome with a special permit. With respect to ocean transport, there were no limiting factors for this case, with one exception: the depth of the river at the end of the journey, from Cadiz to a shipyard at Sevilla, limited by the vessel draft.

Based on the brainstorming session and the limits presented in Figure 10, there were two possibilities to be evaluated in greater detail: road and ocean transportation. Budget quotations for both types of transportation were requested from several different companies based on the same scope in the original RFG.

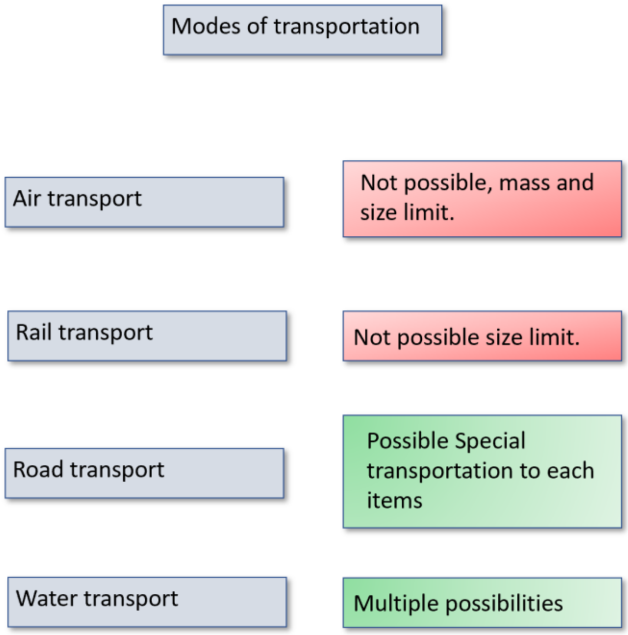

Figure 10. Modes of transportation, and limitations.

Road transportation budget quotations were requested from three different companies in Finland that provided international special cargo transportation. The requested route was from a warehouse inside the port in Kotka, Finland to a shipyard in Sevilla, Spain. All three companies replied but were not particularly keen to offer their services for road transport. Figure 11 summarizes the replies from the road transportation companies.

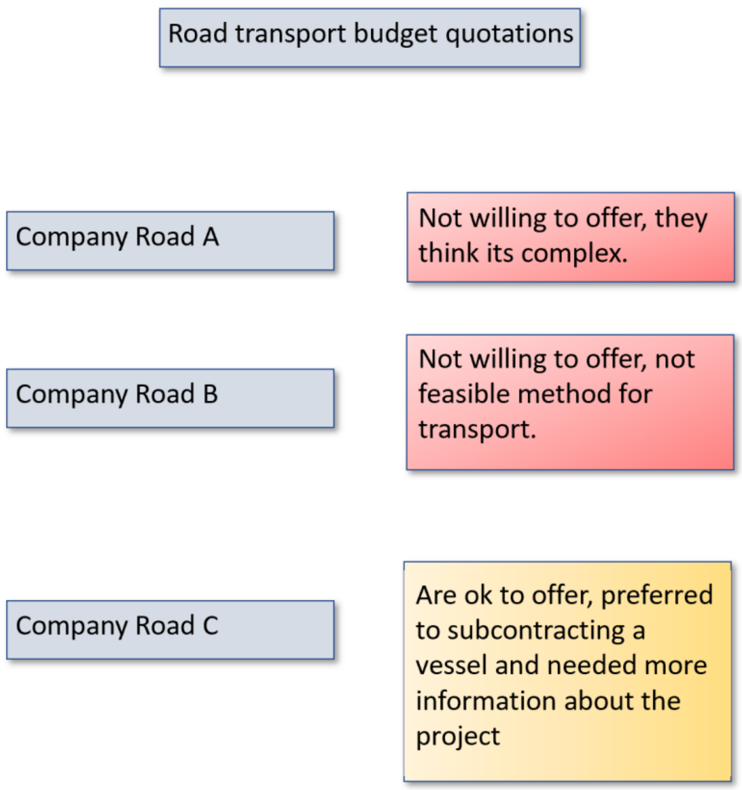

Figure 11. Road transportation budget quotations.

Because road transportation was not economically feasible, based on the quotations and communication from the three companies, the only remaining transportation mode was by vessel, in other words, via marine transportation. Based on the brainstorming sessions and quotations from different road transportation companies, Company X and Company Y decided to begin searching for the best way to transport the items via ocean transportation.

Marine, or ocean, transportation refers to the shipment of goods (cargo) or people by sea and other waterways. More than 80% of world trade occurs by sea, constituting by far the most important means of transportation of goods (The Global Facilitation Partnership for transportation and trade n.d.). Marine transportation is an old-fashioned way of transporting goods, and it continues to expand. It has grown annually by approximately 3.1% in the past three decades (The Global Facilitation Partnership for transportation and trade n.d.).

Because the items to be transported were not ready for loading to any vessel, subcontracted Company Y created a process diagram (see Figure 12) for marine transportation that included all potential lifting and land transportation methods. Based on the diagram, the request for quotation (RFQ) process was executed. The process diagram covers all the decision-making steps.

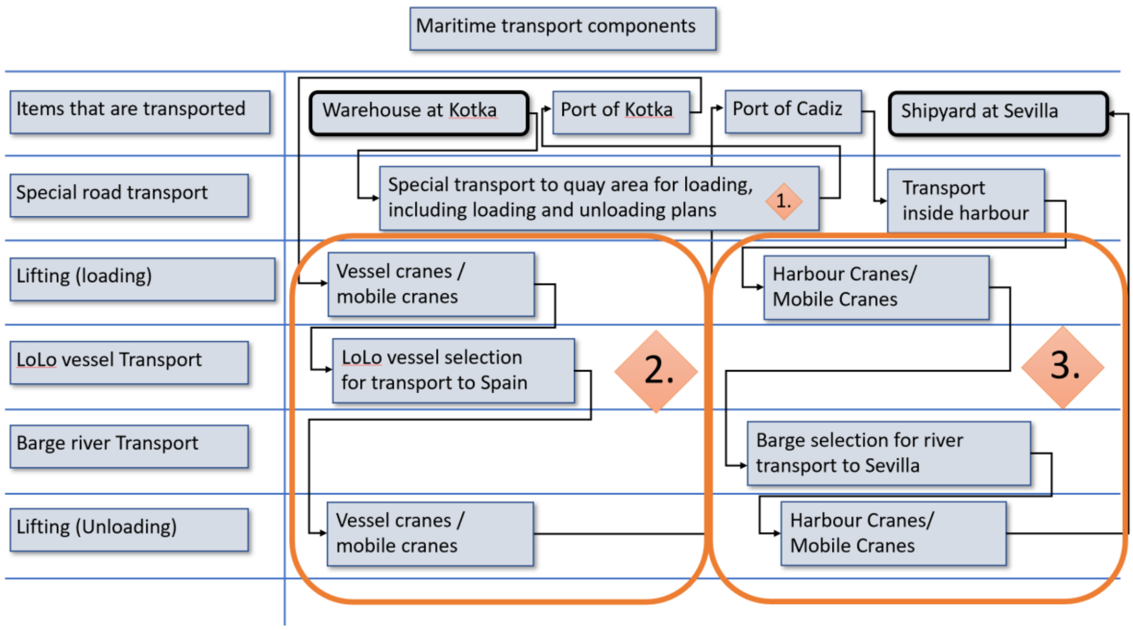

Figure 12. Transport diagram.

The transport process diagram in Figure 12 reveals that there were three different decision-making points. At all three points, the decision-making process was detailed and documented. The first point concerned transporting the items from a warehouse to a quay so that they would be ready for loading onto a vessel. The second decision point concerned selecting the lifting method for loading and unloading the vessel, as well as selecting the vessel used for transportation. Third decision point concerned loading and unloading in Spain, including the river transportation from Cadiz to Sevilla. The decision-making points are marked in Figure 12 with numbered red diamond shapes.

Transportation planning was performed based on the decision-making steps identified from the transportation diagram in Figure 12. The transportation planning chart was vital for identifying all possible risks concerning budget and schedule.

Company Y was used to obtain offers from different service suppliers at different stages of the planned transportation route. It was also used for risk and budget analysis for different decision-making steps. Company Y used decision diagnosis tools to provide a more theoretical way of making the decision, rather than relying on intuition or one-man expertise.

All decision steps were diagnosed based on the Diagnosing your Decision chart, and the appropriate tool for decision-making was selected. Company Y also explained to Company X executives what would be required to receive economically more feasible offers from transportation companies.

3.8 Decision 1: Special Transportation to Quay

The items to be transported were located inside a warehouse in Kotka, Finland. At the beginning, it was clear that the warehouse was unable to transfer the items to the quay area for loading. However, the warehouse company stated that it was willing to help with loading for truck transportation if necessary.

Then, Company Y and Company X worked through the decision diagnosis framework in Figure 14, answering the following questions:

1. Do we know what it will take to succeed, and do we have a full causal model?

In this case, the model was causal. Items had to be transported from the warehouse to the quay, which involved basic heavy transportation with special trailers. The properties of the items that had to be known, such as the weight and COG, were determined at the warehouse in advance. The information was then passed to the transportation company with the RFP process. The transportation instructions were thus very clear.

2. Can the range of possible outcomes be predicted?

For this transportation case, predicting the possible outcomes was simple. If all went as planned, the items would be loaded onto a trailer based on their COG, the trailer would be towed by a truck to the quay, and the trailer would unload the cargo. Loading the cargo would be performed by the trailer, as illustrated in Figure 13. The trailer would be reversed under the items and would then be lifted so that it would actually lift the items. Lifting would be performed by the hydraulic suspension of the trailer.

Figure 13. Type of trailer used for transporting items from warehouse to quay. (Saimanntrailor n.d.).

The only possible failure mode for this transportation involves items falling from the trailer. However, this would be the transportation company’s responsibility, which was clearly marked in the contract.

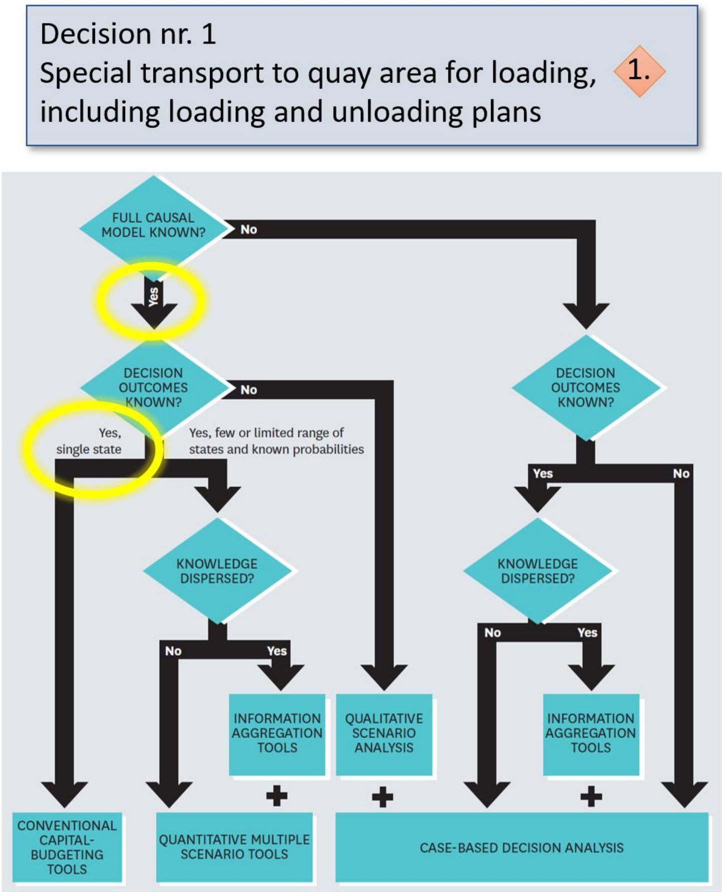

Figure 14. Decision 1 using decision diagnosis framework.

Based on the decision diagnosis framework, Company Y suggested to Company X that typical budgeting tools could be used to determine the optimal contractor. Company X accepted this suggestion and allowed company Y to be responsible for obtaining the quotations and accepting the best contractor.

Company Y requested the price for transporting the two items from the warehouse to the quay area so that the items would be ready for loading onto a vessel. The proposals obtained by company Y were very similar to each other in the terms of price, with the largest difference being the terms of contract concerning the delivery, as illustrated in Figure 15.

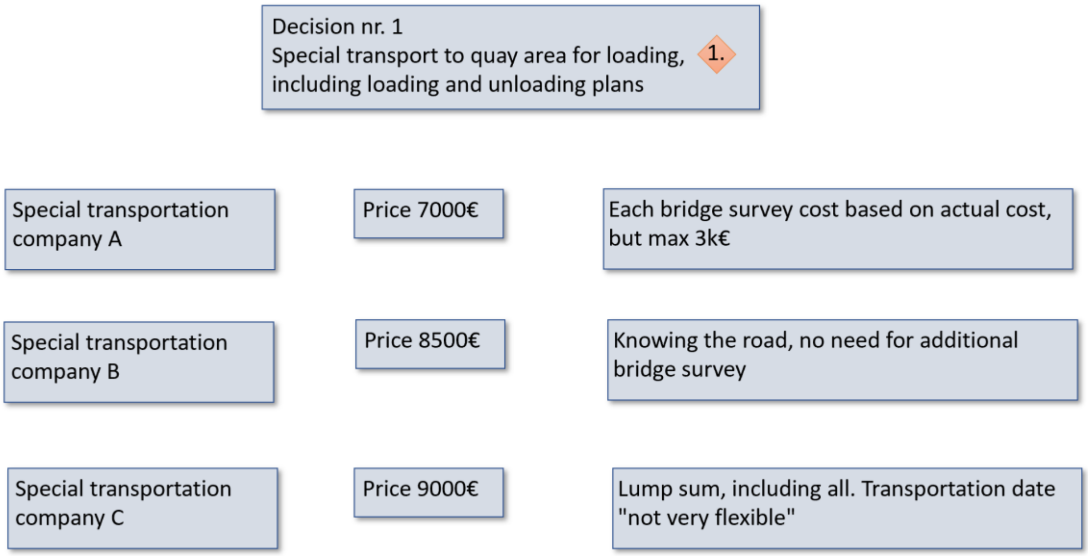

Figure 15. Decision 1: special transportation prices.

A contract was signed with special transportation Company B, because in the proposal by Company A, it was noted that there would be two bridges on route from the warehouse to the quay, and the cost of those would be included. This would have made the total cost of transportation equal to or greater than that for Company B. In addition, Company B already operated in that location; thus, they knew the area well and were contractually flexible.

3.9 Decision 2: Loading, Vessel Selection, And Unloading

At this stage, the items were transported to the port in Kotka and the items were situated at the quay, which was a multipurpose quay with lifting capacity for loading the items. The second decision was crucial with respect to the project budget, as it combined three separate decision-making steps. This decision had to combine answers for the following tasks: how the items would be loaded at the port in Kotka, what the most cost-effective vessel to charter was, and how the items would be unloaded to a selected vessel in the port in Cadiz. Because these three separate steps were strongly interconnected, Company Y suggested to Company X that the three decisions should be combined as one large decision.

Once again, Company Y and Company X performed decision diagnosis, answering the following questions (see Figure 16):

1. Do we know what it will take to succeed, and do we have full causal model?

In the loading case, there was no causal model. Instead, there were several variables that could have an effect on the outcome. For example, if the selected vessel was equipped with cranes, loading and unloading could be achieved with those cranes and no mobile cranes would be required.

2. Can the range of possible outcomes be predicted?

In this case, the outcomes of shipping and unloading were very unpredictable, as there were several ways to lift the items to the vessel. Shipping was also unpredictable, as the vessel would depart from Kotka but, depending on the weather, the route would potentially change, which would have an effect on the schedule. In addition, if there was any other cargo, the vessel would potentially stop at another port prior to the port in Cadiz.

Unloading is a similar task to loading. In general, the risks of the lifts are relatively low; because the lifts are not very common, they are carefully planned and documented in advance. In addition, the lifting setup is verified by a third party for insurance purposes. Shipping takes place between the commercial harbors, and pilotage service are used. Furthermore, shipping and lifting are covered by insurance, and the documentation is verified prior to any operations.

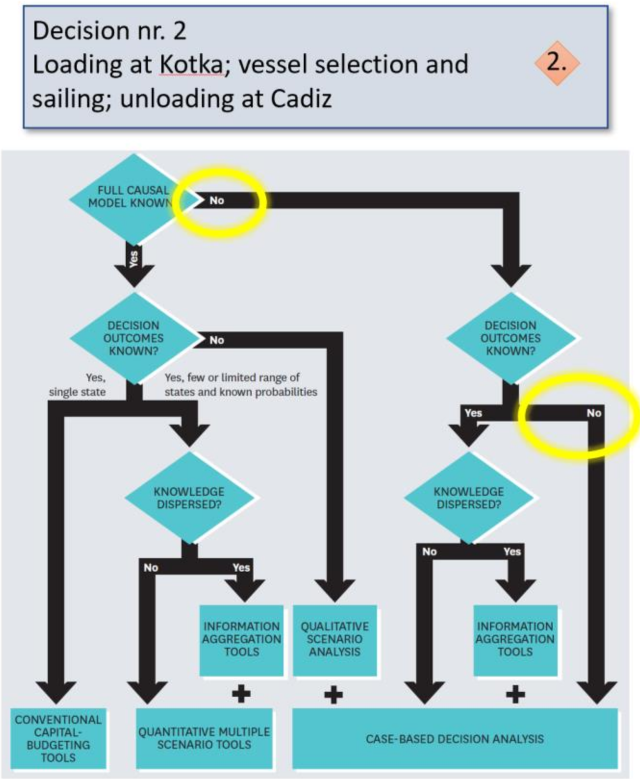

Figure 16. Decision 2 using decision diagnosis framework.

Based on the decision diagnosis framework, Company Y suggested to Company X that for the second decision, they should use case-based decision analysis. Company Y suggested that they could compare two different types of vessels, conventional and LoLo (lift on / Lift off) with cranes, for the transportation, and compare the prices of a mobile crane and harbor crane for loading and unloading. These different loading methods could then be analyzed for a better understanding of their differences. Company X accepted this approach that was suggested by Company Y.

Several different types of vessels are available for shipping goods around the world. One type is a LoLo vessel, which can transport different products with a flexible cargo space and load/unload cargo with onboard cranes. Company Y contacted several shipping companies and requested a proposal for transporting the two items for Company X. Company Y received replies from six shipowners and created a table to compare the prices for the main parts of the proposal (see Table 1). The table also includes the cargo type.

Table 1. Shipping companies' budget proposals

	Shipowner A	Shipowner B	Shipowner B	Shipowner C	Shipowner D	Shipowner E	Shipowner F	Shipowner F
Price	118 200 €	198 000 €	270 000 €	129 000 €	144 000 €	144 000 €	126 000 €	210 000 €
Cargo type	part cargo	part cargo	Sole Cargo	Part Cargo	part cargo	sole cargo	part cargo	Sole Cargo
Cranes	N/A	N/A	With Cranes	N/A	N/A	N/A	N/A	With Cranes
Other notes:	Vessel age >25y							
		Average price without cranes	143 200 €		Average price with cranes	240 000 €		

Based on the prices presented in Table 1, Company Y calculated the average price for transporting the items and presented them to company X. Using a conventional vessel without cranes was priced at approximately 143,200 euros, while using a LoLo vessel with cranes was priced at approximately 240,000 euros. The price difference between conventional and LoLo vessels was thus approximately 96,800 euros. The quay in Kotka, Finland where the items were located was equipped with suitable harbor cranes for loading the items. However, in Cadiz, Spain, there were no harbor cranes available. Thus, a harbor crane was required in Finland for loading, and a mobile crane was required in Spain for unloading. Company X wished to know the estimated cost of loading and unloading to have a better understanding of the best vessel to use. For this purpose, Company Y created a draft lifting capacity drawing (see Figure 17) for the unloading port, which was accepted by Company X.

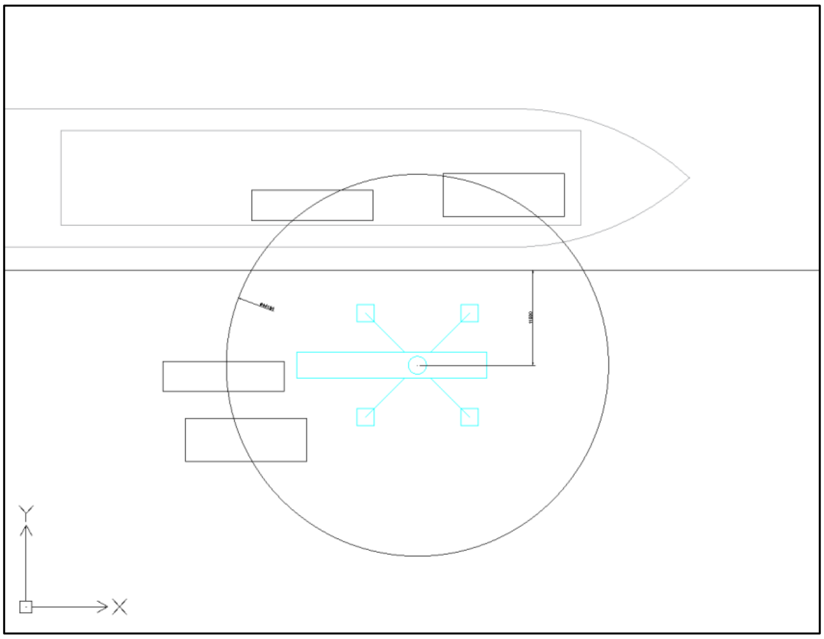

Figure 17. Lifting capacity drawing.

Based on the item transportation drawing and the draft lifting capacity drawing, Company Y requested proposals from two different mobile crane companies; in addition, it requested the price of using the harbor crane at the port in Kotka. Based on the RFQ process, Company Y obtained the results (seeTable 2) from two companies that could provide the lifting service in Cadiz, and one port operator's budget proposal.

Table 2. Lifting prices

	Harbour crane usage at Kotka	Mobile crane company A	Mobile crane company B
Price for mob/ demob	N/A	74 400,00 €	38 800,00 €
Dayrate	2 500 €	6 400,00 €	10 400,00 €
Lifting aids	8300	12 200,00 €	11 200,00 €
Other notes:	Gantry crane	Lifting will be based on use of crawler crane	Lifting will be based on use of two cranes, Duallift. Lifting capacity is at limit, needs to confirmed at site later on.

Next, Company Y provided the necessary information to Company X for making the decision regarding lifting and vessel selection. Company X and Company Y performed an estimation of the total cost of the transportation project from Kotka to Cadiz (see Table 3) based on the different lifting options and vessels. The estimated cost included a lower and upper bound of the price levels based on unknowns during the operation. During the estimation, the risks, pros, and cons of all the options were also evaluated.

Table 3. Total cost estimation

	CASE 1.		
Operation and selectec operator	Lower bound	Upper bound	Notes
Vessel	210 000 €	270 000 €	
Loading	- €	- €	Inlcuded vessel price
Unloading	- €	- €	Inlcuded vessel price
Total price	210 000 €	270 000 €	

	CASE 2.		
Operation and selectec operator	Lower bound	Upper bound	Notes
Vessel	210 000 €	270 000 €	
Loading	2 500 €	10 800 €	8500€ max for lifting aids, if needed
Unloading	- €	- €	Inlcuded vessel price
Total price	212 500 €	280 800 €	

	CASE 3.		
Operation and selectec operator	Lower bound	Upper bound	Notes
Vessel	118 200 €	198 000 €	
Loading	2 500 €	10 800 €	8500€ max for lifting aids, if needed
Unloading	86 600 €	93 000 €	Incl. mobilization + lifting aids, +upper bound incl. one extra day
Total price	207 300 €	301 800 €	

	CASE 4.		
Operation and selectec operator	Lower bound	Upper bound	Notes
Vessel	118 200 €	198 000 €	
Loading	2 500 €	10 800 €	8500€ max for lifting aids, if needed
Unloading	50 000 €	60 400 €	Incl. mobilization + lifting aids, +upper bound incl. one extra day
Total price	170 700 €	269 200 €	

Based on the total cost estimation, Company Y determined that the cheapest method was Case 4; however, it carried some risks that could also lead to higher costs. Company

Y presented a SWOT analysis to company X based on different loading and unloading methods. A SWOT analysis, which is based on strengths, weaknesses, opportunities, and threats, was performed for each method. The first SWOT analysis (see Figure 18) was based on the use of a LoLo vessel with cranes that could load and unload the items. The greatest strength of using this type of vessel was the availability of a crane on the vessel, which would eliminate the risk of external cranes being delayed for loading or unloading. At the same time, the company would not be required to pay extra to obtain a mobile crane at the port upon arrival. The greatest weaknesses of this type of vessel, however, were cost and availability. The opportunities were that the vessel's crew would handle all lifting-related issues, including the lifting gear. The threats were also related to the lifting process; for example, if the vessel were unable to load/unload the items with its cranes, the project would experience great delays.

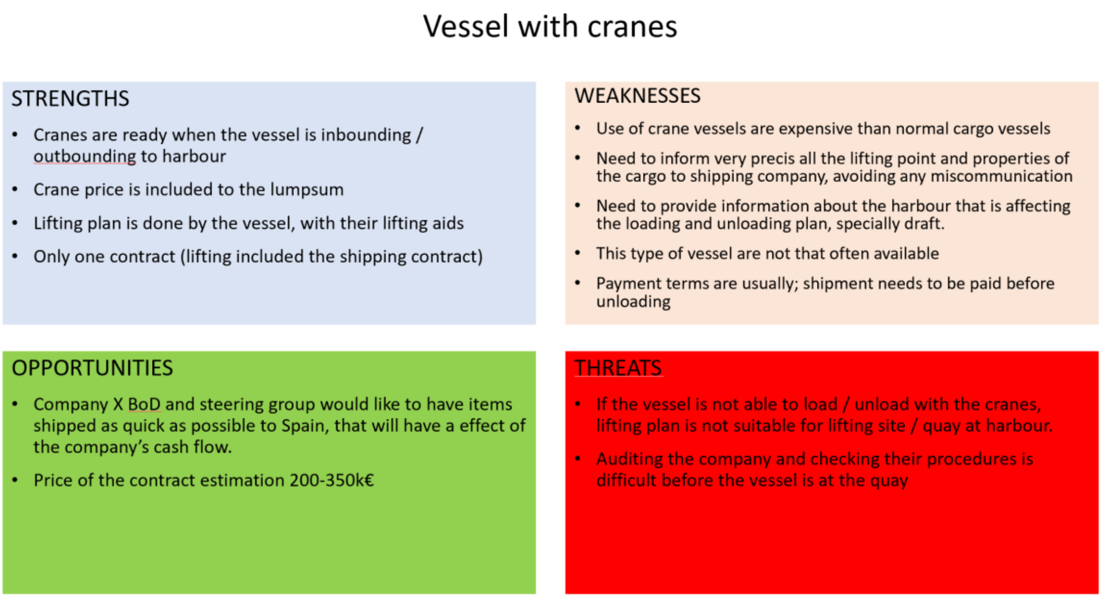

Figure 18. SWOT analysis for vessel with cranes.

The second analyzed method was based on the usage of mobile cranes, as illustrated in Figure 19. Mobiles cranes are commonly used for short-term special lifting operations. In this transportation case, the items would be relative heavy for the mobile cranes, and the reach (i.e., the distance the items must be lifted) would be relatively long. The strengths of using mobile cranes were that lifting would be very precise; compared to typical vessel cranes, mobile cranes are more accurate. In addition, the use of mobile cranes would allow for the use of conventional vessels, which are usually less expensive. The weaknesses of using mobile cranes were that the items to be transported were quite heavy, and as a result, the available cranes that could handle this type of lifting would be low. As a result of the low availability of larger cranes, the costs would rise. The opportunities for using mobile cranes included the use of conventional vessels, which would save money. The threats of using mobile cranes involve two separate contracts that would have to be used, which could cause unexpected delays, generating a cost.

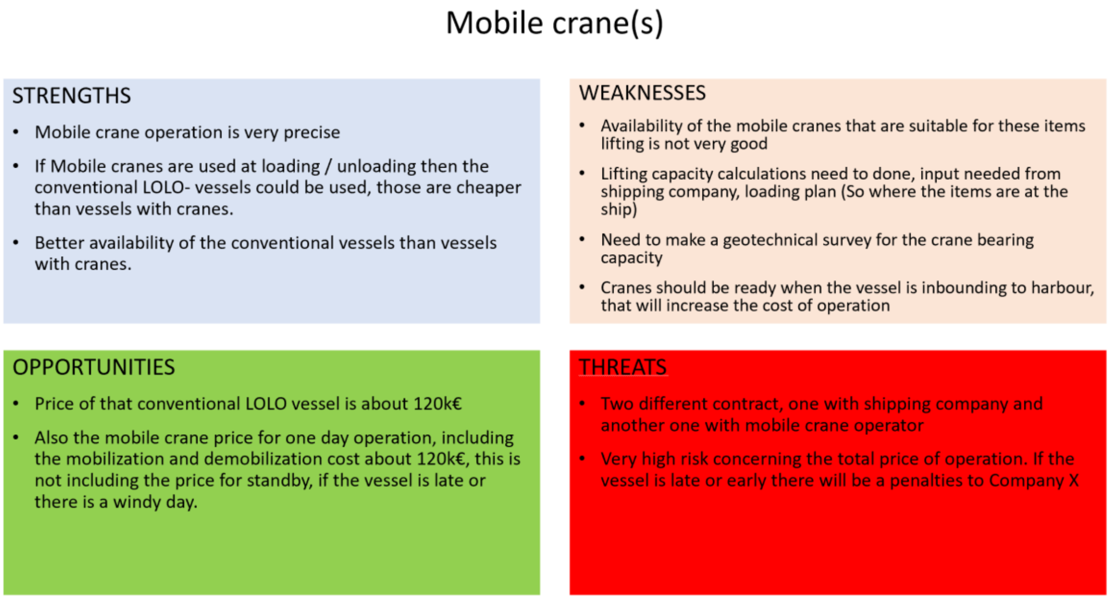

Figure 19. SWOT analysis for conventional vessel and mobile crane(s).

The third analyzed lifting method involved the use of harbor cranes (see Figure 20). The strengths of using harbor cranes were that the cranes would already be at the loading site. In addition, using the cranes would be relatively inexpensive, and the use of a conventional vessel would be possible. In this lifting case, however, the harbor crane operator lacked suitable lifting gear for these items, which was a weakness. The opportunities for using harbor cranes included the use of conventional vessels, which would save money as the mobile crane(s). As a threat, this scenario would involve a third contractual partner if a conventional vessel were to be used.

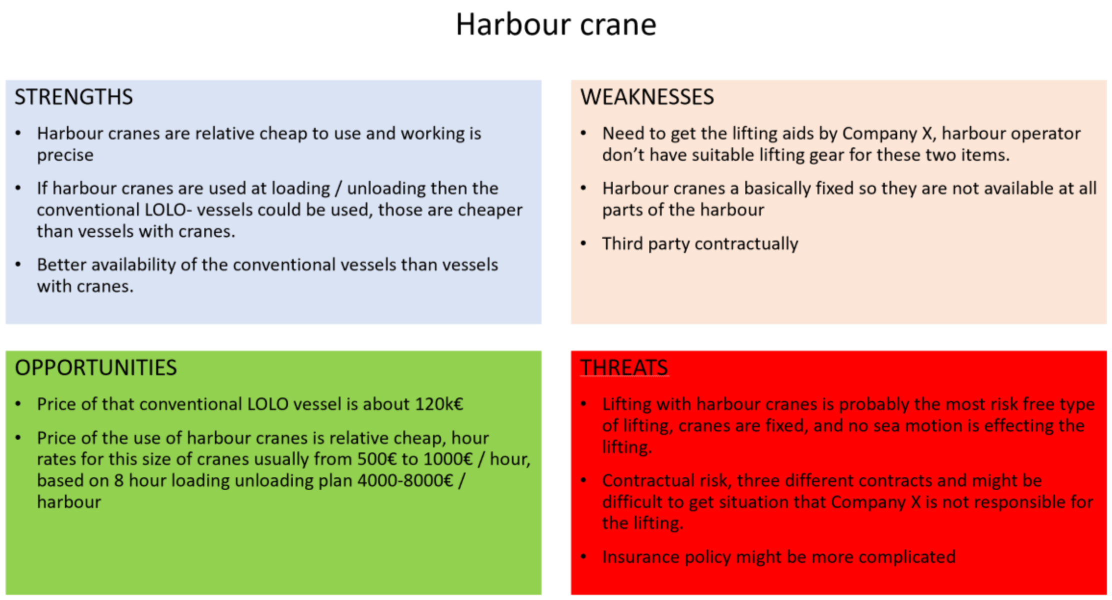

Figure 20. SWOT analysis for harbor crane.

Another decision for Company X to make pertained to cargo type, that is, determining whether other cargo would be present in the selected vessel. This was a cost-related decision; if the selected vessel transported only items for Company X, the price would be higher than if the vessel simply picked up the items for Company X and delivered them to the desired port when convenient for the shipowner.

Based on budget proposals, SWOT analysis, and two different cargo types, Company X decided to make the decision based on a weighted decision matrix, which is presented in Figure 21. The decision matrix factors were analyzed for four different cases, and the matrix was weighted such that the budget price and price range had the largest impact weight, while the pros and cons had the smallest weight.

FACTOR	Budget price points	Budget price range	SWOT analysis risk	SWOT Pros / Cons	Total Score
Weights	5	4	3	2	
CASE 1.	2	1	2	1	22
CASE 2.	3	2	1	2	30
CASE 3.	4	3	3	3	47
CASE 4.	1	4	4	3	39
Lower points are better					

Figure 21. Weighted decision matrix providing weighted assessment of different cases.

Based on the weighted decision matrix, Company X decided to select the budget proposal of shipowner F and use vessel cranes for loading and unloading. With this decision, there was also a backup plan. If any problems arose during loading with the vessel cranes, the company could use the harbor cranes as a backup option in Finland. In Spain, it would be possible to use mobile crane if necessary.

3.10 Decision 3: From Cadiz to Sevilla

Prior to any subsequent decisions, the items were unloaded at the port in Cadiz and situated at a multipurpose quay that did not have lifting capacity for loading onto barges. Making this third decision was simpler than the second decision because there was a way to transport the items inside the port. Port transportation was executed with a special transportation trailer that was available at the port. The cost of operation was also relatively inexpensive; it was thus clear to Company X that it would select this option. To make a decision regarding loading, the barge for river transport, and the unloading company, Company Y and Company X performed decision diagnosis, answering the questions below, as illustrated in Figure 22.

1. Do we know what it will take to succeed, and do we have a full causal model?

   In this case, there was no causal model. There were several variables that could have an effect on the outcome, such as the lifting arrangement, barge, and unloading.

2. Can the range of possible outcomes be predicted?

   For loading, shipping, and unloading, the outcomes were very unpredictable, as there were several different methods of lifting the items onto a barge. Shipping was also very unpredictable, and unloading was similar to loading.

   In general, the risks in these lifting operations were similar to those in the previous operations in Decision 2. Based on the risks of lifting, the lifts were carefully planned and documented.

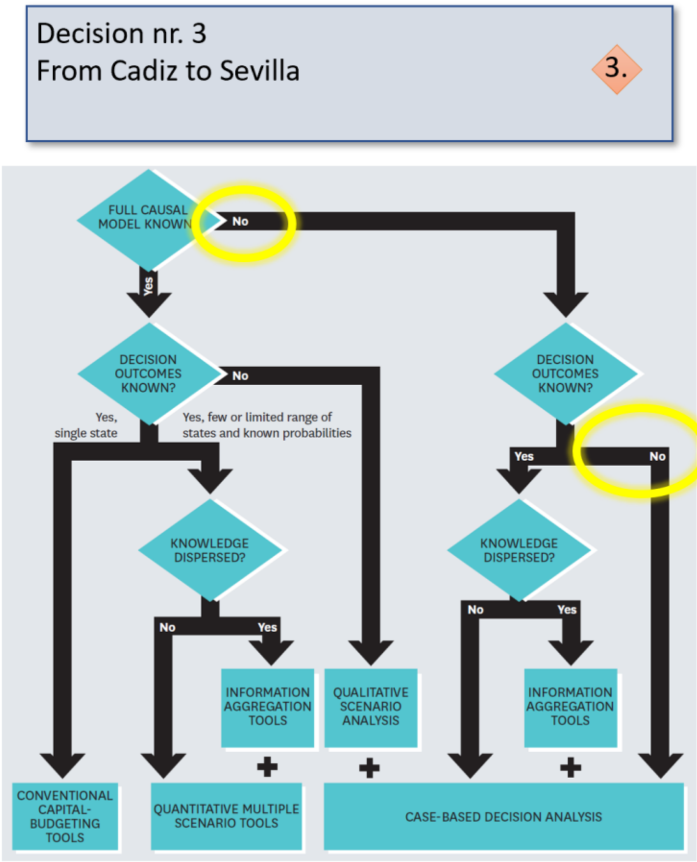

Figure 22. Decision 3: From Cadiz to Sevilla

Because there were many similarities to Decision 2, Company Y used the same analysis basis for this decision whenever possible. The decision-making process at decision 3 based on process points that were introduced at Chapter 2.1 as follows:

1. Creating a constructive environment and define the goal

In this case, Company X and Company Y performed a brainstorming session to define the scope of work for the final part of the transportation. Based on the session, the scope of work was defined as transporting the items from the Cadiz multipurpose quay to the shipyard in Sevilla.

2. Gathering information and generating effective alternatives

Prior to contacting any shipowners or lifting companies, Company Y researched potential special transportation companies for the final part of the transportation and determined that there were two special transportation companies in Spain that operated between Cadiz and Sevilla. In addition, these companies had a fleet that included a suitable barge for transporting the items. Company Y requested a budget proposal from both companies based on the scope of work that was determined in the brainstorming session.

3. Weighing the alternatives

After receiving the proposals from both service providers in Spain (see Figure 23), Company X decided to use services instead of attempting to manage the final part of the journey from Finland.

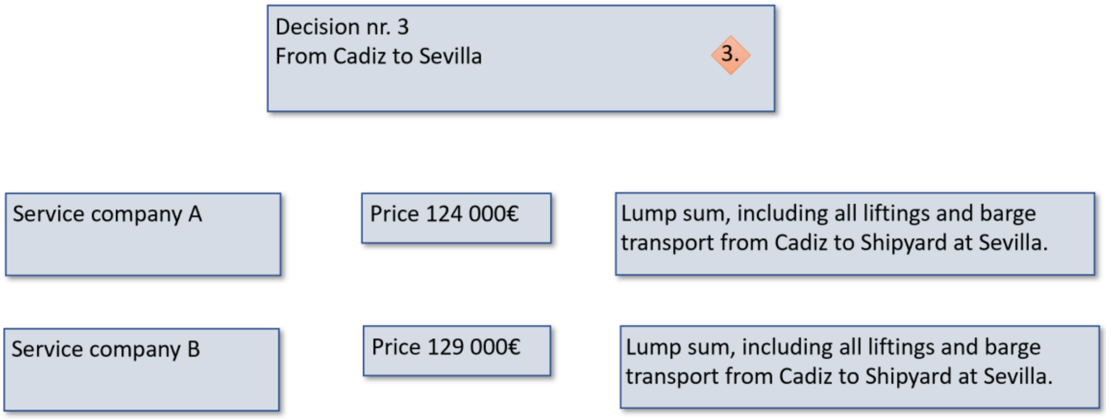

Figure 23. Service price from Cadiz to Sevilla.

Two proposals were evaluated and were deemed to be very similar to one another with respect to the price, scope, and terms. Company Y performed a SWOT analysis for using the transport company as a service, as seen in Figure 24. The SWOT analysis revealed that there were strengths to subcontracting and using a single contract, and opportunity for a new partnership. As a weakness and a threat, the SWOT analysis marked the use of new subcontractor.

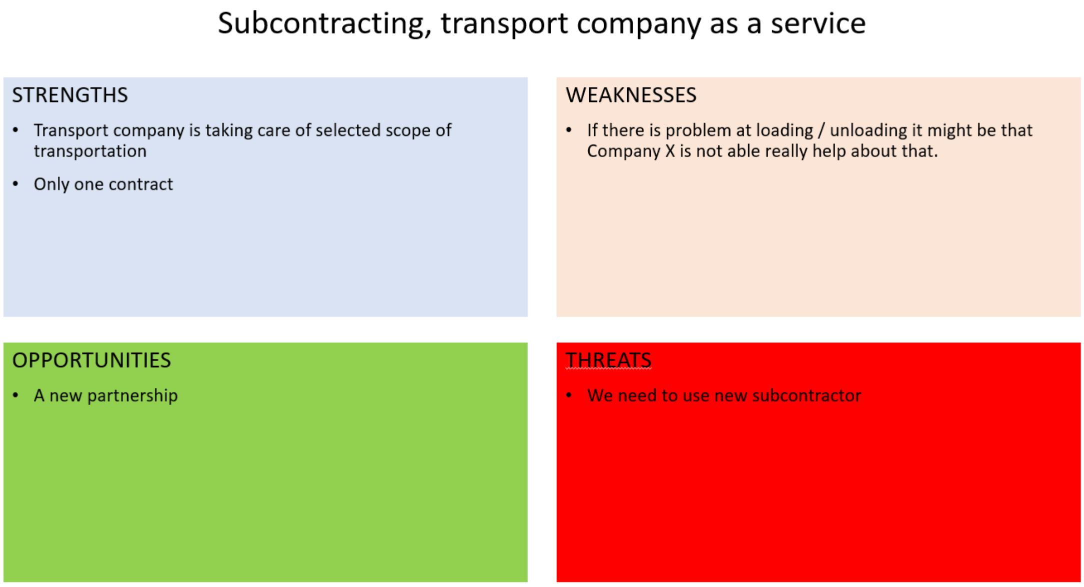

Figure 24. SWOT analysis of transportation as a service.

4. Select the most suitable option

Because there were two relatively similar proposals, Company X decided to select the one with the lower price.

5. Verify the decision, plan and execute

Because the final part of the shipment was subcontracted and purchased as a service, Company X used Company Y to supervise the operation in Spain. A dedicated employee from Company Y traveled with the items from Cadiz to Sevilla and was the contact person on behalf of Company X.

6. Review the decision, perform follow-up actions

Company Y's dedicated employee also composed a report of the entire transportation process when the items were unloaded at the shipyard in Seville. Based on the report, Company X would be able to develop future transportation plans.

3.11 Case Result

By splitting the original scope, Company X and Company Y earned savings for the project. With the original scope of work, the price levels ranged from 435,000 to 460,000 euros; however, with the split scope of work, Company X was able to save 92,500 euros. An itemized list of the costs of different decisions is presented in Figure 25.

Original scope of work		
Cheapest offer from service provider	**435 000,00 €**	Transportation as a service
Split scope of work price of decisions		
Transport from warehouse to quay at Port of Kotka	7 000,00 €	Special transportation company A
Marine freight from Kotka to Cadiz	210 000,00 €	Shipowner F, sole cargo with cranes
Transport inside the port of Cadiz	1 500,00 €	Port of Cadiz special transport trailer
Barge river transport Cadiz to Sevilla	124 000,00 €	Service company A
Total price of the transportation	**342 500,00 €**	
Saving of the project by split scope of work	**92 500,00 €**	without cost of the Company Y

Figure 25. Itemized list of costs for different decisions.

The steel part transportation provided a real-life example case of decision-making process and also served an example of the split scope of work. Company X was able to save 92,500 euros by splitting the original scope of work into three smaller tasks and effective decision-making process. The delivery of the project on budget was vital for the future of Company X and now Company X is nogosiating a new project delivery.

4 Conclusion

The aim of this thesis was to introduce the decision-making process. Several supplemental tools were used in the steel transportation case, in which two items were shipped from Finland to Spain. Decision-making was performed to obtain cost savings, as the original budget proposal was too expensive, and the project was thus not feasible. The steel parts transportation case results revealed that major cost savings were gained by splitting the original scope of work into three smaller tasks. Implementing more demanding project management and a decision-making process led to savings of 92,500 euros for Company X. Some of these savings were used for subcontracting Company Y, and Company X also likely used more internal hours than they would have if the original scope were used. However, the method by which the transportation was achieved made the total delivery project a profitable one for Company X. Company X also learned that shipping large items is very expensive, and they understood that professional information regarding the shipping business was required prior to the next project proposal.

Upon examining the decision diagnosis framework during the writing process, it became clear that in many cases, case-based decision-making is more appropriate than using MATLAB or Excel formulas. Personnally I believe that the most critical part of decision-making is the information that decision makers must use with conventional decision tools and methods.In particular, case-based decision-making should be used when decision makers do not know the exact relationship between the critical success factor and outcomes. Analogous thinking, learning from past success stories, and avoiding the failures of others may constitute the path to success.

Decision-making is a fascinating subject and can be examined using many different approaches. In this thesis, I have only grazed a small portion of this topic; however, my theoretical knowledge of the decision-making process greatly developed during of writing this thesis. I also learned how important understanding a decision is.

This thesis was a long project, written from December 2018 to March 2019, and it was occasionally quite difficult to progress in the right direction. The work was rewarding, however, and I learned a lot about decision-making and learned many ways to improve my skills in analyzing and conducting a decision-making process. In future work, it may be interesting to perform a Monte Carlo analysis for different shipping cases, including the probabilities of malfunctions and weather conditions that can influence the loading and unloading operations.

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