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The formation and management of costs during the developmental phase of a wind farm project

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wind farm project**

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Bachelor's thesis
Spring 2024
Business Administration
Oulu University of Applied Sciences

ABSTRACT

Oulu University of Applied Sciences
Degree Programme in Business Administration, Financial Administration

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Title of thesis: The formation and management of costs during the developmental phase of a wind farm project

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Term and year when the thesis was submitted: Spring 2024

Number of pages: 41 + 6 appendices

The thesis examined the costs of the project development phase of a wind power project, how the costs are distributed over the different phases of project development and how they can be managed. The work was carried out by researching the theoretical background of the topic, interviewing two professionals in the field, and creating a project cost report for the commissioning company. The topic was limited to an onshore wind project and the development phase of a project. The commissioner of the thesis is VSB Uusiutuva Energia Suomi Oy.

The aim of the thesis was to gain a greater understanding of cost management, how costs are distributed over the different stages of project development and what is a practical tool for cost reporting. As a development task, a project cost report was created with the aim of simplifying cost monitoring and forecasting. The project cost report was created for the project development team and the finance team of the commissioning company.

The theoretical base consists of literature on project management, texts published by an association in the field and interviews with two professionals in the field. The theoretical base covers project development cost categories, cost breakdown by phases and milestones, cost forecasting and changes, cash flow forecasting and cost reporting.

The research methods used for the development assignment were internal workshops with the project development team and participatory observation. The needs and different stages of development of the project cost report are assessed together with the relevant parties to ensure that it met their needs. The work utilized the previous experience of the author and other personnel with reporting and assessed the features and shortcomings of the existing reporting.

A further development task for the project cost report is to create a written guideline for the use of the report, which will ensure consistent use and continuity of operations. In the future, the report will include the number of internal work hours of the personnel. The data will be used to monitor how many work hours different tasks and project phases require.

Keywords: cost management, cost reporting, project costs, project phases, wind power

TIIVISTELMÄ

Oulun ammattikorkeakoulu
Liiketalouden koulutusohjelma, taloushallinto

Tekijä: Olivia Taskila

Opinnäytetyön nimi: Tuulivoimapuiston hankekehitysvaiheen kustannusten muodostuminen ja hallinta

Työn ohjaaja: Erkki Raudaskoski

Työn valmistumislukukausi ja -vuosi: Kevät 2024

Sivumäärä: 41 + 6 liitettä

Opinnäytetyössä tutkittiin tuulivoimaprojektin hankekehitysvaiheen kustannuksia, niiden jakaantumista hankekehityksen eri vaiheille ja sitä, kuinka kustannuksia voidaan hallita. Työ toteutettiin syventymällä aihealueen teoriaan, haastattelemalla kahta alan ammattilaista ja luomalla projektikustannusraportti toimeksiantajalle. Aihe rajattiin maatuulivoimahankkeeseen ja hankkeen kehitysvaiheeseen. Työn toimeksiantajana toimii VSB Uusiutuva Energia Suomi Oy.

Opinnäytetyön tavoitteena oli saada laajempi ymmärrys kustannusten hallinnasta, miten kustannukset jakaantuvat hankekehityksen eri vaiheille ja millainen on hyvä työkalu kustannusten raportointiin. Kehittämistehtävänä luotiin projektikustannusraportti, jonka tavoitteena oli yksinkertaistaa kustannusten seurantaa ja ennakointia. Projektikustannusraportin loppukäyttäjät ovat hankekehitystiimi sekä talousosasto.

Tietoperusta koostuu projektihallinnan kirjallisuudesta, alan yhdistyksen julkaisemista teksteistä sekä kahden alan ammattilaisen haastatteluista. Tietoperusta käsittelee hankekehityksen kustannuskategorioita, kustannusten jakaantumista vaiheisiin ja välitavoitteisiin, kustannusten muutoksia, kassavirran ennakointia sekä kustannusten raportointia.

Kehittämistehtävän tutkimusmenetelminä käytettiin workshopeja hankekehitystiimin kanssa ja osallistuvaa havainnointia. Projektikustannusraportin tarpeita ja eri kehitysvaiheita arvioitiin yhdessä loppukäyttäjien kanssa, jotta se vastaisi heidän tarpeitaan. Työssä hyödynnettiin tekijän ja muun henkilöstön aiempaa kokemusta raportoinnista sekä arvioitiin olemassa olevan raportoinnin ominaisuuksia ja puutteita.

Projektikustannusraportin jatkokehitystehtävänä luodaan raportin käytölle kirjallinen ohje, joka varmistaa yhtenäisen käytön ja toiminnan jatkuvuuden. Raporttiin tahdotaan sisällyttää toimeksiantajan sisäisten työtuntien määrät ja niiden myötä seurata, kuinka paljon eri työtehtävät ja projektin vaiheet vaativat tiimin työtunteja.

Avainsanat: kustannusten hallinta, kustannusten raportointi, projektikustannukset, projektin vaiheet, tuulivoima

TABLE OF CONTENTS

1	INTRODUCTION	6
1.1	The commissioner and their current situation	6
1.2	Research objectives and methods	7
2	PROJECT	10
2.1	Cost categories	10
2.2	Project phasing.....	13
2.3	Project life cycle	14
3	PROJECT COST MANAGEMENT	17
3.1	Estimating the costs of project development	17
3.1.1	Mistakes and risks in cost estimating	19
3.1.2	Changes in costs	20
3.2	Monitoring and forecasting costs	21
3.2.1	Difficulty in monitoring costs.....	22
3.2.2	Forecasting cash flow	23
3.2.3	Work hours.....	24
3.3	Exceeding a budget.....	25
3.4	Reporting.....	26
4	PROJECT COST REPORT	27
4.1	VSB Uusiutuva Energia Suomi Oy	27
4.2	Choice of topic.....	28
4.3	Interviews in the field	28
4.4	Planning of the report	29
4.5	Conducting the report.....	30
5	CONCLUSIONS	36
6	REFLECTIONS.....	38
6.1	Further development	39
	SOURCES	40
	APPENDICES.....	42

1 INTRODUCTION

Project management is planning, directing, organizing, and controlling company resources. It is designed to make better use of resources to complete specific goals and objectives. (Kerzner 2013, 4.) Cost monitoring ensures the financial implementation of the project. Monitoring and reporting must contain up-to-date information, manage costs, cover all costs and be regular. (Pelin 2020, 172.)

Wind energy is an investment-heavy sector. Most of the costs of a wind power project are incurred during the investment phase (Suomen Tuulivoimayhdistys 2023c). An onshore wind farm's investment cost is roughly calculated to be 1,2–1,5 million euros per megawatt. In comparison, an offshore wind farm's investment cost is 20-50% higher. (Suomen Tuulivoimayhdistys 2023a.) By nature, project development has many risks and steps that can suspend development momentarily, cause additional costs or cause the project to be terminated. During development money is invested in the project, and if at any phase the project is terminated, the project will not produce revenue to pay back for the invested funds. It is important to recognize the invested funds and to allocate them to the correct project and project phase.

1.1 The commissioner and their current situation

This thesis is commissioned by VSB Uusiutuva Energia Suomi Oy. VSB is a project developer in the renewable energy field. VSB wants to examine their onshore wind farms' project development phases' costs, what the costs consist of and how to monitor them. The company's projects are long-term, and they have multiple phases that have their own criteria and characteristics. The phases and phase criteria form in the same way in each onshore wind farm project. At VSB the development phase is divided into four sections. The sections' duration varies from six months to four years. The projects consist of multiple tasks and subtasks that vary in length. Certain tasks, such as communication and marketing, last for the duration of the project and thus incur costs frequently. While other tasks, such as building permits, although at task level the process is broad, and they require rather a lot of time and effort, the cost is nonrecurring. Long tasks and their subtasks, such as EIA (environmental impact assessment) can last through the different phases of the project.

The commissioner's wish is to obtain a view of cost monitoring by cost categories, how the costs are distributed to different project phases and tasks, and how many work hours the team contributes to the project and which tasks take up the most work hours, and by that creates more costs than other tasks. The thesis' development task is to create a project cost report. The report is internal and directed to the project development team as well as to the finance team, who will use it to have a comprehensible overview of a project's financial status.

The project cost report displays the budgeted costs in relation to actual incurred costs, divides the costs into phases and in conclusion shows how much time, money, and work hours it takes for the project to move from one phase to the next. Phase distribution of the costs gives an overview of which of the phases and tasks are the costliest. Understanding the distribution of costs facilitates the prioritization of resources between projects and the timeliness of transferring a project phase. Contracts made between VSB, and third parties can have a duration of several years and the scope of purchased tasks is often broad. It is important to have various summaries of tasks and to be able to easily track additional work. The report helps to demonstrate which of the project phases, tasks or suppliers are the most expensive. These can be monitored, and efforts can be made to save money in the future. The awareness and outline provided by the project cost report will serve as a tool for future contract negotiations. The task content of the contracts for future projects can be assessed more accurately.

Unexpected costs, such as additional work and research, may arise in various tasks and third-party contracts. Notice of these costs should be taken and considered if they should be expected in the following projects as well. With the project cost report VSB obtains a clear image of the cost formation, which then helps with budgeting, project pricing, and gives a more precise price for project development and to its different phases.

1.2 Research objectives and methods

The aim of the research is to gain better understanding of the cost formation to different phases within the developmental phase of a wind farm project. The objective is to create a concrete tool that makes project cost monitoring more straightforward and simpler for the project development team and the finance team. The objective is reached by researching existing data of cost reports

and internal data of costs, project phases, and work hours. The data is from VSB's accounting system, budgets, and work time logging system. The existing internal cost data is deemed reliable and accurate since overhead costs are low and recognized due to the accounting method and the variety of dimensions used.

To gain more in-depth information of the costs and characteristics of an onshore wind farm, two professionals in the field were interviewed: a Senior Development Manager Pauli Maaninka from Taaleri Energia Oy and a Head of Development Veli-Pekka Alkula from OX2 Finland Oy. Both Pauli and Veli-Pekka have worked in the energy field for over 15 years and have broad expertise on energy projects. The interviews were conducted as a thematic interview (appendix 1 and appendix 2). The themes of the interviews were costs and cost categories that occur in wind projects, cash flow monitoring and forecasting, wind projects' special characteristics and possible risks caused by them. Tuomi & Sarajärvi (2018, chapter 3.1) consider the benefit of thematic interview to be that it allows the interviewer to specify and deepen the questions during the interview (Tuomi & Sarajärvi 2018, chapter 3.1).

Participatory observation was used to recognize the needs and further development of the project cost report. The observation process enabled the professional skills and previous experience of all key personnel to be utilized. (Tuomi & Sarajärvi 2018, chapter 3.2.) Internal workshops were held to gain a deeper understanding of the needs and functionalities that the report should have. The workshops highlighted open discussion, ideas, needs, and author's questions related to the report. The workshops were attended by specialists from the project development team. In the beginning the report required manual work but through further development the goal is to add automatic aspects to it and have the report be as convenient as possible. The thesis focused on project development cost formation and phases, the construction phase as well as the sale phase and their costs are left out. Another delimitation on the thesis was that the work is suitable and focused on onshore wind farms and neither the thesis report nor the project cost report as such is suitable for offshore wind farm projects. The wind power projects discussed in the thesis include only onshore wind power projects.

The research questions are:

1. How much time, money, and work hours it takes to complete a project phase?
2. How are the costs divided into different project phases?
3. How can the costs be monitored effectively?

In the thesis I learned more regarding cost formation, management, and monitoring. My goal was to learn the components of a functional and informative project cost report and to create a report that best serves the needs of the commissioner. The thesis is written as a developmental thesis, and it consists of two parts. The first part is a thesis report and the second is creating a project cost report as a developmental task. The thesis's purpose is to develop a tool that increases cost traceability, making it simple to see the whole project's costs in one place with the help of charts, summarized figures, and filters.

2 PROJECT

A project can be defined as a set of activities and tasks that have a specific objective to be achieved within certain specifications, pre-agreed start, and end dates, are multifunctional and use human and non-human resources, and often have a limited amount of funding (Kerzner 2013, 2).

The outcome of a project is subject to technical, qualitative, time and resource constraints. Taking all these constraints into account, simultaneous management is difficult. These constraints are interlinked: if the project timetable is shortened, quality may be compromised, and more resources are used. Particularly in customer projects, it is vital to manage the scope of the constraints to make the business profitable. It can be said that successful project management is the lifeblood of project companies. (Pelin 2020, 18.)

2.1 Cost categories

The overall duration of an onshore wind farm project is affected by several factors. These include the size of the wind farm and the timing of the studies to be carried out. The familiarity of the local and regional authorities with the wind projects also has an impact on the overall duration. On average, a medium sized onshore wind project, approximately 10 wind turbines, takes 4-6 years from the preliminary studies to a completed wind farm. (Suomen Tuulivoimayhdistys 2023b.) Other factors affecting the duration include the municipality's opinion, the general acceptance of wind power by residents in the area and possible complaints. In addition, land ownership can have a significant impact, if the project area has large properties land acquiring can be completed more quickly compared to if the properties are small and there are many owners. In this case, it will take considerably greater time to contact and meet the landowners.

Generally, a wind farm project is divided into phases and milestones. The required milestones and tasks can be carried out in parallel and overlapping. Often zoning the area for wind energy and environmental impact assessment studies are carried out simultaneously which allows the hearings to be held at the same time. Figure 1 shows in summary the required steps in which a wind power project should be carried out. (Suomen Tuulivoimayhdistys 2023b.)

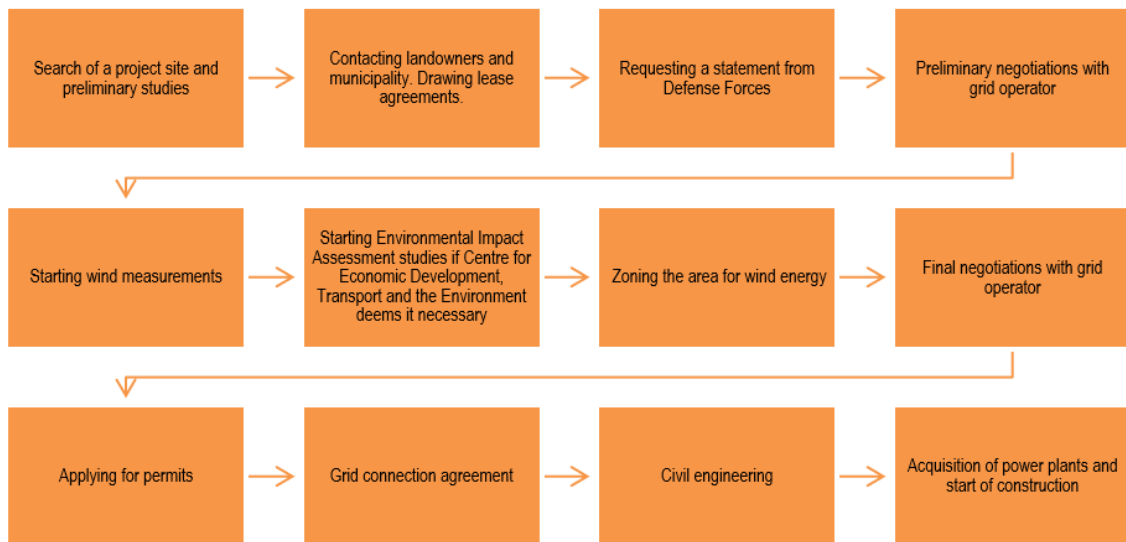


FIGURE 1. Required steps to be taken in a wind power project (Suomen Tuulivoimayhdistys 2023b).

The cost of a wind farm's development phase can be divided into different cost categories according to the tasks and phases of the development phase. Cost categories that include the required milestones and tasks are company specific. Cost categories facilitate budgeting, cost monitoring and forecasting. At Taaleri Energia Oy the project development costs for a wind power project consist of the following cost categories:

1. Environmental impact assessment
2. Land use planning
3. External planning, such as land or road planning
4. Grid planning
5. Wind measurement
6. External legal services
7. Administrative and accounting costs
8. Own work costs. (Maaninka 2023.)

OX2 Finland Oy categorizes the development costs at a top level as follows:

1. Internal costs, work hours and own work
2. Specialist services
3. Public authority costs
4. Stakeholder management and communication. (Alkula 2024.)

Specialist services include environmental consultancy, technical design, and legal services. The most significant item in terms of public authority costs is the cost of the building permits, which can be over 10 000 euros per wind turbine. Grand total for project's building permits depends on the number of wind turbines and the municipality where the project is located. (Alkula 2024.)

The number of work hours required for each stage and task depends on the company and their working practices. Various services and tasks can be outsourced, which reduces the number of hours required from the project developer. It can be said that EIA (environmental impact assessment), land use planning and land acquisition require a lot of effort and work hours. Land acquisition and leasing requires meetings, travelling, and the organization of events, which is quite time-consuming. Landowners are kept informed by letters among other ways, this requires internal effort, including mailing. (Maaninka 2023.) The EIA procedure examines the impact of the project and its extent on the project environment. The process provides an understanding of the significance of the environmental impacts and the means to prevent adverse effects. (Ymparisto.fi 2022.) If the EIA studies are started at the ideal time, in autumn or winter, the duration is approximately a year (Envineer 2023).

Land use and related works require a lot of work hours from the company. There are specialist partners for land use, but much of the work is done in-house. EIA and zoning, although outsourced services, require precision and work hours from the project developer. Reports and work produced by consultants need to be reviewed to ensure internal control and management. (Alkula 2024.)

Generally, there are four types of costs that occur in a project: labour, material, equipment, and overhead costs. Labor costs are easy to identify, they are costs that enable a project and can be linked to production or service such as salaries, benefits, bonuses, overtime, personnel insurance, pension costs, and payroll taxes. Material costs include all project materials purchased by the company. Direct costs include raw materials, various parts and components and other production supplies. Indirect costs include, for example, freight and insurance. It would be beneficial to separate equipment costs from material costs when considering the cost structure. Equipment varies with departments and companies, for example in the IT sector equipment includes computers, printers, scanners, systems, and software. Overhead costs are underlying running costs that cannot be directly allocated to a specific cost or cost type. Such costs include taxes, office space, rent, electricity, and other costs that are necessary for the operation. (Malsam 2023.)

2.2 Project phasing

During the project planning, it is valuable to split the project into different phases. Splitting project into smaller sections increases the project's manageability. Project's tasks are split to support task planning, implementation and to have a better overview of the costs. If the splitting is done attentively, it enhances the project's probability of success. (Mäntyneva 2016, 61.)

At Taaleri Energia Oy the project development is divided into three stages, early, mid, and late stage. The mid stage is the most expensive. The mid stage includes large costs such as permitting and wind measurement. The early stage costs are relatively lower, but the workload is high as it involves a lot of land acquisition work. Late stage can include building permit costs, which are a big cost item in Finland. Each stage has its own criteria, tasks, and budgets within which the project will be developed. The contents of the stages and the need for studies vary from country to country, but the main stages are similar in all countries of the company, allowing clear reporting and facilitating the monitoring of the progress of projects at both project and country level. Reporting and staging are also used to develop scenarios for projects to determine when they are ready for investment. The criteria and work tasks serve as a broad scale guide, but the progress of each project is monitored at project level, and the criteria and work tasks in the phases may not always occur in a predefined way, and work tasks may overlap. In particular, the early stage and mid stage may have overlapping tasks. The late stage focuses on the preparation of the investment. (Maaninka 2023.)

The stages are used to assess the continuation of a project. One critical element in the early stage is land acquisition. For example, if only 30% of the land in the project area has been acquired and it is deemed nearly impossible to acquire the rest of the land, it can result in a decision to stop development of the project. (Maaninka 2023.)

The phasing of the project development phase and progress milestones are company specific. Instead of stages, the progress of the development can also be monitored through a series of milestones. It is worth having several milestones during the project development phase, including milestones that assess the viability of moving the project forward and whether further funding is warranted. Alkula sees the most important milestone as the approval of the project's zoning proposal by the municipality. Achieving this will significantly reduce the development risk of the project. (Alkula 2024.)

Despite the ways of monitoring project development progress, perhaps all project developers have a screening phase. This is when a lot of internal work is done within the organisation to find and evaluate potential projects. The screening phase is characterised by project identification, risk identification, initial development, and assessment of project's potential. Project progressivity is an assessment of the risk level in relation to the cost, how much cost to put in at a certain level of progressivity. (Alkula 2024.)

Achieving milestones adds value to the project and provides certainty and security in the use of money. As the project progresses, the risks decrease and it becomes clearer how to identify and react to issues that could hinder the project, and as the risks decreases, the use of money can be safely increased. It is essential to assess how much money must be spent before major milestones and whether there may be any costs that can be left for post-milestone periods. Alkula mentions wind measurements as an item to consider leaving until after the zoning proposal has been submitted, wind measurements are expensive, so it might be reasonable to do them after the development risk has decreased. (Alkula 2024.)

2.3 Project life cycle

Projects and project development can be divided into distinct phases depending on the needs and practices of the project developer. Mäntyneva (2016, 17) divides a project's life cycle into four stages: preparation, planning, implementation, and closure. Life cycle gives a full image and a duration for a project. The duration of the stages varies, a project may be in the preparation for years before anything concrete. (Mäntyneva 2016,17.)

Each stage of the life cycle requires time and effort. Figure 2 shows how the workload increases as the time and stages pass. The implementation stage is longest in its duration, and it has the highest amount of workload. (Mäntyneva 2016, 18.)

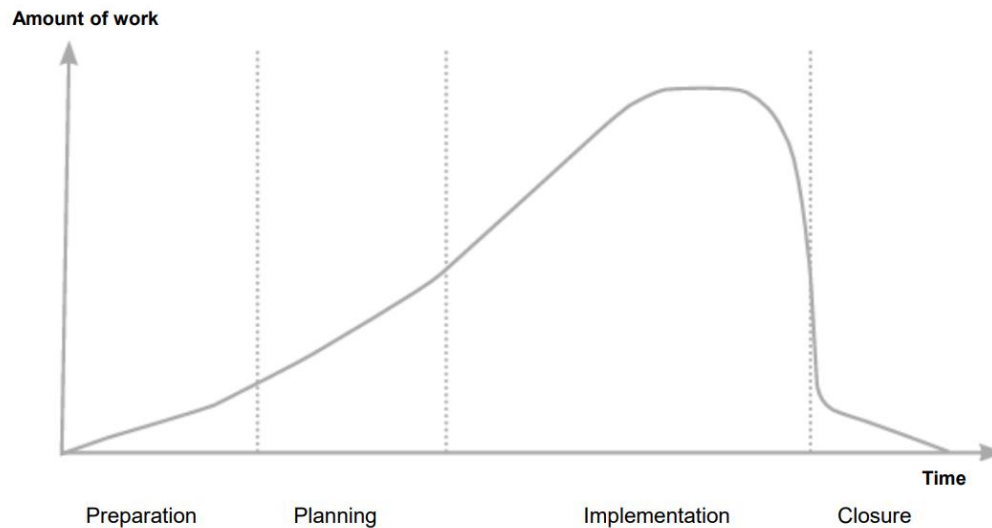


FIGURE 2. Example of project's life cycle stages and workload (Adapted from Mäntyneva 2016, 18).

Each project is driven by a specific need, which can determine the scope and focus of the project. The preparation phase of a social infrastructure project can take up to decades, as it involves land acquisition, zoning, financing, and connecting with different stakeholders. During the preparation phase, it may be realized that the project idea is not worth implementing and the project will be terminated early on. (Mäntyneva 2016, 19.)

Thoroughly executed preparation ensures and eases the project to proceed to the planning stage. Once a project idea is determined worth implementing it gets moved to the planning stage. During the planning stage the project's objectives are set, and its scope and coverage defined. To reach set objectives, several solution alternatives for the project are created. The most appropriate alternative in terms of time and cost is selected. The project is divided into actions and resources, people, and a time frame is allocated to these activities. It is important to identify potential risks and issues already in the planning stage and to create an action plan for them. The planning process and the decisions taken during the planning process are documented in the project plan. (Mäntyneva 2016, 19.)

The implementation stage follows the actions and solutions documented in the project plan. As the project continues and more information is available, the project plan needs to be adjusted when deemed necessary. During implementation the project's progress and usage of resources is monitored closely. The most crucial task is to identify issues that can possibly be in the way of the

progress and the closure of the project. The sooner the issues are detected, the sooner necessary actions can be taken. (Mäntyneva 2016, 19.)

When a project's objectives are reached, and the project manager has prepared a final project report, the project is considered to be in its closure stage. The project report includes conclusions of the project's progress, mention of possible changes to the project plan, project documentation and evaluation of the project. The project report ensures that learned lessons are documented and can be considered in the following projects. (Mäntyneva 2016, 19–20.)

Project's closure is a stage that must be done with care. If the closure is prolonged, more resources are wasted. During the closure stage the rest of the open activities are closed to officially close the project. Lastly the project documents are finished and archived. (Mäntyneva 2016, 20.)

3 PROJECT COST MANAGEMENT

Project cost management does not only cover budgeting but also cost estimating and monitoring. Its goal is to ensure that the project is implemented cost-effectively and profitably. Project's cost management starts early in a planning phase when the project's resources, scope and timeline are determined. In the early stages of a project the cost estimates tend to be rough and indicative. Previous experience with similar types of projects gives guidance to the responsible party with cost estimates. (Mäntyneva 2016, 77–78.) With proper resource control a project manager can ensure the availability and sufficiency of resources. Resource control helps the project to stay on budget, timeline and upon agreed quality. (Mäntyneva 2016, 55.)

3.1 Estimating the costs of project development

Both underestimating and overestimating the project's costs can be harmful to the future of the project. If the cost estimate is too high, the conclusion can be that the project is not worth implementing. If the cost estimate is done too optimistically, it creates unrealistic financial goals that may be impossible for the project manager to accomplish. In addition, the pressure to stay on the optimistic estimate can lead to wrong priorities in terms of quality requirements, for example. The range of cost estimates varies depending on the overall duration and scope of the project. The estimates for short-term projects tend to be more accurate because they do not have as many time-related risks as long-term projects. (Mäntyneva 2016, 78–79.)

Estimating the costs of a wind project is simple at best. It is known that a project will always have certain costs, such as wind measurement, EIA, grid planning, zoning, legal services, and administrative costs. Experience and clarity on the project will help to create a good and workable budget framework, which will be refined as the project progresses. Experience has shown that it is a good idea to include a contingency for additional studies when the estimates are being drawn up. Once the cost framework has been established precisely by cost category and with sufficient contingency amount, forecasting is no more than a process of adjusting cost schedules. (Maaninka 2023.) There is a lot of changeability in budgeting and costs, the scope of studies needed for a project varies

from one project to another, which can make evaluation difficult. When budgeting for project development, the contingency can amount to tens of percent of the cost of project development. In comparison, the equivalent amount for a construction project can be 3%. (Alkula 2024.)

The cost assessment consists of different steps. Cost estimates are usually divided into three categories, the preliminary cost estimate, the basic cost estimate, and the final cost estimate. These estimates vary in their accuracy, both in terms of monetary amounts and price data. The preliminary cost estimate serves as a tool for the preliminary planning. The estimate is used for profitability calculations and financial estimates. It uses a small team of experts and relatively little time. It is based on general price data for main machinery and equipment and other costs. The accuracy of the preliminary cost estimate ranges from -20% to +40%. (Pelin 2020, 163.)

Once the planning is more advanced and the project has more specifications, a basic cost estimate is made. This estimate is based on preliminary tenders, task and equipment lists, the overall project schedule, and any expert estimates and plans such as architect drawings, electrification plans and instrumentation diagrams. If the company has carried out a similar project in the past, its cost data can be used by considering the cost index. The final investment decision will be based on this estimate. Normally, the accuracy of the basic cost estimate is +/- 10%. (Pelin 2020, 163–164.)

Once most of the procurement has been agreed, the main contracting agreements have been signed and the plans are almost complete, the final cost estimate is drawn up. In general, the project is well advanced at this stage. The accuracy of the final cost estimate is between 3% and 8%. Figure 3 demonstrates each cost estimate's margin of error in per cent value compared to time. (Pelin 2020, 164.)

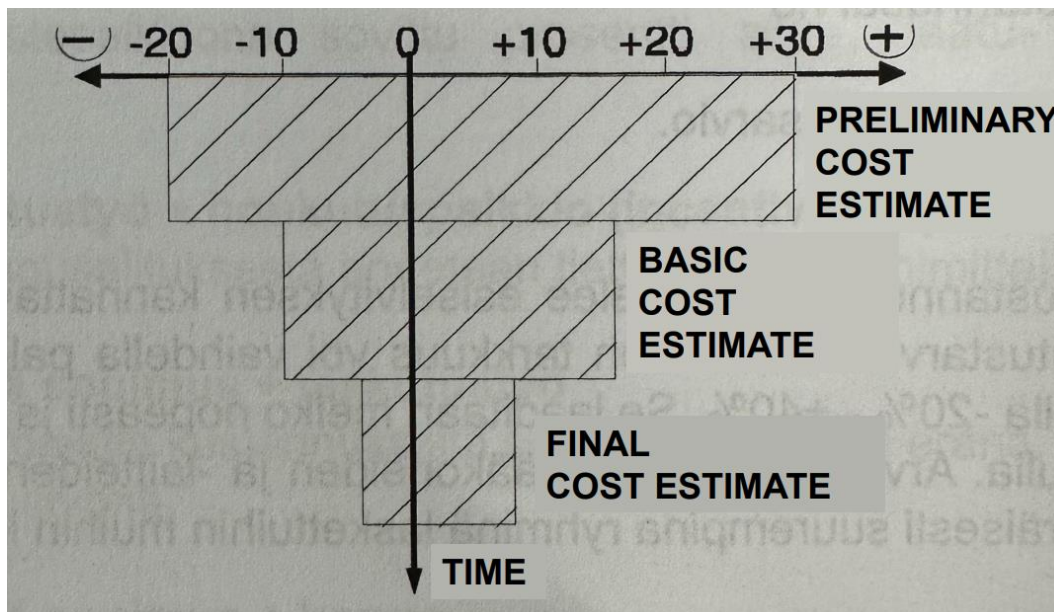


FIGURE 3. Margins of error in cost estimates (Adapted from Pelin 2020, 164).

3.1.1 Mistakes and risks in cost estimating

Project costs may need to be planned over a long period of time or without extensive preparation, resulting in rough estimates of figures and schedules. Estimates are potential risks if they are not documented accurately enough. It is important to include in the documentation how the estimate was made: what assumptions were made, and what factors may affect the accuracy or validity of the estimate. It is also useful to note the assumed percentage range between the estimate made and the actual outcome. Doing so the risk of treating the estimates as absolute targets is avoided, and it makes the factors behind the estimates known. (Mäntyneva 2016, 83.)

When estimating project costs the same typical mistakes are often made. The mistakes come from assumptions, ambiguity, and uncertainty. The risk of inaccurate estimates arises for example when unforeseen events are not anticipated, the cost estimates are made in a hurry and under pressure, or the project has predefined total sum and the estimations are desperate way to try to fit in it. Other mistakes are that resources are assumed to be fully available solely for the project, time and effort requirements for tasks are not clear and if project tasks are not assigned to specific people. (Mäntyneva 2016, 83–84.)

To avoid making mistakes and to successfully estimate the project's costs the project team could utilize one's previous experience with a similar project or use a consultant to obtain a third-party

view of the estimated costs. What comes to resources and time frame, the correct assumption would be that a full-time project worker is expected to have 80% of their total time effectively used for the project, not 100%. It is important to note that people tend to underestimate the workload of a task and it can take time to transition to a new project all together. (Mäntyneva 2016, 84.)

It is easier to estimate the costs when the project is divided into smaller phases and tasks and their sums are added up to reach the total cost of the project. Good communication makes planning and estimating clearer. It is important to keep the project commissioner aware that as the project planning is refined, there may be more work to be done to complete the project deliverables within the project. The actual incurring costs of the project should be communicated to the commissioner regularly. The commissioner should also be communicated of any assumptions and limitations related to the scope and coverage of the project. (Mäntyneva 2016, 84.)

3.1.2 Changes in costs

There are several different factors that can affect the cost of a project, both internal and external. These changes may be caused by the project organization, for example, lack of experience with a similar project, changes in legislation, different objectives of the project staff and other participants, large number of subcontractors or logistical constraints. (Mäntyneva 2016, 81–82.)

Project development may be delayed, and the project may have to be suspended due to, for example, complaints, changes in legislation or the need for additional studies. Depending on the reason for the delay, the project may be delayed by more than a year. The delay does not suspend costs, but various reservation fees and costs for further studies occur. Also, filing responses to complaints requires a lot of work hours from the company, as well as external services such as legal services. Possible additional studies, responses and reservation fees are anticipated in the budget from the very start, and in total, an extra 10% of the project development cost, for example, can be set aside as contingency. This 10% is used to provide for unexpected costs. (Maaninka 2023.)

The assessment of the cost of project development in the early stages of a project is strongly based on experience. In reality, the cost of the development can vary by +/- 25% of the initial assessment. The cost of project development and consultancy work has increased over the years. Maaninka

has been working in the industry for over 15 years and over the years the EIA report has changed from 200 pages to 600 pages and the wind measurement equipment has become more expensive and the length of the measurement campaign has increased. (Maaninka 2023.)

Changes can also come from market conditions. Raw materials and other supplies may be more expensive than estimated, and exchange rate differences may affect the price of supplies. Strict timetable can create a difficult situation. If there is no flexibility in the estimated project costs, with high procurement costs along with a tight deadline, causing extra work for the project staff this all combined can create a situation where even small changes in the workload can cause the budget to be exceeded. Changes may also be due to technical challenges. Constant technological change can create increasing costs and mean that the original project plan must be modified. In addition, high demands on reliability create pressure and costs. An overall project solution may consist of several complex sub-components and thus constitute a costly overall solution for the project. (Mäntyneva 2016, 82.)

Changes, surprises, and additions in costs are common in the development of wind power. During the project, the project area may need to be altered, which will require further studies for the new area. (Maaninka 2023.) Additional work may come as a surprise, a sensitive environmental site may be found in the project area that requires further investigation, leading to additional costs. There may be a change in the interpretation of the authorities, with a greater emphasis on a particular issue than before. Such issues often change with the times, and it is important to identify them to prepare for costs as early as possible. There are many changing elements in project development during the process that can lead to costs. (Alkula 2024.)

3.2 Monitoring and forecasting costs

A project is managed by monitoring its progress, finances, and quality. The management and follow-up can be done through a project report. The report includes several topics, such as a description of the overall project status, an updated schedule, the cost situation, risks, and the quality status of the project. The schedule should include an assessment of whether the project will be completed within the target schedule, the project's actual budget, potential and actual risks, and the project manager's proposed decisions on the previously mentioned topics. The project report will aim to be concise and focus on deviations and their possible causes. (Mäntyneva 2016, 93.)

A good cost management system provides clear information of a project's progress, highlights key events, helps to identify problems, gives an overview of linked time and economic progress, and anticipates future cost developments (Pelin 2020, 158). Cost monitoring will help the project to achieve its financial objectives. Comparing the project's cost performance against budget estimates is a key task for the project manager to ensure that the project stays within the budget target. (Mäntyneva 2016, 98.) Deviations tend to occur in the project's budget and schedule targets. Deviations can be quite large, but they are not necessarily critical or major. (Mäntyneva 2016, 96.) According to Kerzner (2013, 630) many people have a limited understanding of cost control. People think that it is just monitoring costs, but it also involves recording and analyzing data. Analysis allows corrective action to be taken as soon as inconsistencies are identified. Cost monitoring should involve all those who incur costs, not just the project manager or management. (Kerzner 2013, 630.)

Usually, project's cost monitoring is directly linked to line organization's cost monitoring, invoicing, and accounting. (Pelin 2020, 172.) In accounting, project costs are distinguished from other costs by recording them either in the project cost center or in another object that provides sufficient reporting accuracy (Mäntyneva 2016, 99). Being linked to the line organization creates a risk that monitoring becomes a passive way to see incurred costs rather than actively monitoring and analyzing incurred and future costs. (Pelin 2020, 172.)

3.2.1 Difficulty in monitoring costs

In the early stages of project development, costs are incurred that are difficult to monitor and allocate. The costs of planning and exploring project areas run a high risk of becoming part of the overhead costs. This risk can be reduced by setting up an internal project for the potential project as early as possible and by establishing clear procedures for the identification, tracking and allocation of costs and work hours. Early creation of an internal project ensures that costs can be correctly allocated and later transferred to a project company, a special purpose vehicle (SPV). Accurate tracking and categorization of work hours allows for the reimbursement of the value of work hours in the event of an internal sale of the SPV. (Maaninka 2023.) There may be costs in project development, especially in the screening phase, that benefit more than one project. How these costs are monitored is company specific. Costs can be allocated to projects that benefit from it or, alternatively, left as overheads. (Alkula 2024.)

Tracking costs and hours worked can be difficult if project details, such as the project name, change as the project progresses or if internal systems or practices change during the project. Initial costs are largely made up of consultancy costs and work hours. The need to monitor costs and work hours has become more acute over the years and it may not be possible to use historical data if it does not contain information that meets current requirements. Maaninka suggests that the need for more accurate tracking of costs and work hours may have been partly driven by project sponsors' desire to know more about the costs of these items. The change in needs is an opportunity to improve and the increased information on work hours can be used to summarize the work hours required for each phase of the work. (Maaninka 2023.)

Another challenge in cost monitoring can be that it does not consider the project's timeline and its changes. Being under budget can be seen as a saving in costs when the project may be behind schedule and the costs have not yet been incurred. This is often because cost monitoring and scheduling are separate functions, and the budget is not updated with schedule changes. As a result, it is not known what proportion of the cost variance is due to schedule variance and it becomes difficult to predict the financial outcome of the project during the project. (Pelin 2020, 182.)

If cost monitoring is unclear, the following topics, among others, can be used to approach the issue:

1. The approved budget of the project and the status of its significant items.
2. Status report of the person responsible for monitoring the budget and the costs incurred.
3. Costs allocated to the project and purchase invoices.
4. Review of the method of reporting and tracking the costs incurred.
5. Examples of measures to be taken in case the budget is exceeded.
6. Timeliness of the budget. (Mäntyneva 2016, 99.)

3.2.2 Forecasting cash flow

Project-specific cost forecasting requires input from those involved, such as project managers. As an example, cash flow forecasting can be ensured by project managers reviewing costs monthly. Budgeting and forecasting are separate functions, the budget is set once a year and is not often revised afterwards. The forecast is updated monthly for an agreed period, such as next 12 months. Alkula feels that the most important principle of forecasting is that an explanation is added to the

cost. An explanation ensures continuity of operations, so that everyone who looks at the costs knows what meaning each figure has. The importance of this is emphasised during personnel changes, it is vital that the costs and explanations in the forecast are understandable to people other than the forecasters themselves. The finance department is interested in when costs are due, but it can be difficult to estimate at times. For external services, it can be difficult to estimate when a decision is made, when the invoice is issued and, consequently, when the due date is. From a cash flow perspective, it is better to estimate the cost too early than too late to have time to prepare for the cost. At times, uncertainty about the timing of the cost means that the cost is moved forward by a month every month in the forecast. Uncertainty is reduced by the regularity of forecasting. (Alkula 2024.)

Regularity and an adequate contingency amount are key to monitoring and forecasting costs. Regular checking ensures that there are no surprises and contingency ensures that additional costs are financially prepared for. Monitoring and forecasting can be carried out on a monthly or quarterly basis, for example. At Taaleri Energia Oy cost monitoring and forecasting is reported on a quarterly basis, with a particular focus on the next two quarters. Reporting is done for all projects and the information goes to the main system. In the report, senior management can see the financial status of the projects and an estimate of when each project is expected to be permitted. These reports can be used to create scenarios and draw conclusions. (Maaninka 2023.)

Costs are monitored in intervals, calculating the project costs incurred over time, the costs incurred for contracts related to the project and the work in progress to the extent that costs have been incurred. The focus of project cost monitoring is on identifying differences between budget and actual costs and anticipating their potential impact on total cost. (Mäntyneva 2016, 99.)

3.2.3 Work hours

To have functional and realistic cost estimation the workload needs to be included. Employees have the most knowledge regarding workloads of different tasks and they should be made part of the workload estimation process. Using previous project's hour monitoring logs and making estimations for each individual task can result in more accurate estimation. As the project progresses, the tasks and the workload of the tasks require became clearer. It is crucial to follow-up and update the estimation as clearer information is available. (Mäntyneva 2016, 81.)

By calculating work hours, they can be used to create milestones and schedules for the project team. Task duration expectations can be made by estimating how many project hours a task will take and assigning wanted amount to do the task. For example, if a task takes eight hours, it can take one person a week to finish when using one project hour to it a day, but if the task is assigned to eight people, it can be done in a day, if everyone works on it for one hour. (Indeed 2023.)

Project hour estimations can be used to create budgets. The hours give an estimation of how many professionals are needed to complete a task in time. The estimations can then be used to calculate work hours as a cost type. (Indeed 2023.)

3.3 Exceeding a budget

It is prevalent for a project to exceed its budget. An attempt can be made to balance the budget by ensuring that invoiceable work for the project has been invoiced and the income has been entered into the accounts. Consideration can also be given to whether it would be possible to obtain an additional return on the project's resources, whether cheaper resources can be used or, alternatively, whether non-essential resources can be dispensed with. One option is to look at the project schedule and the remaining workload to see if it could be completed in a shorter time frame or with fewer work hours than originally planned. (Mäntyneva 2016, 100.)

Annual budgets for wind farm development projects are frequently underrun due to project delays, resulting in planned costs not being incurred in the year as planned. Another problem can be that too much of extra has been added to the budget. This may be due to catastrophic thinking, which is exacerbated by the fact that there are multiple variable elements in a project development. When the aim is to develop and progress projects, going over budget can be seen even as a positive thing. This indicates that project milestones and tasks have progressed. Budgeting must be able to respond to contingencies, unexpected changes and delays. With delays, the realisation of project profit is delayed. (Alkula 2024.)

During project development, especially in the final stages, there may be a situation where the project budget may have already been spent and the need for additional studies or statements arise.

In such cases, a decision on funding and its continuation will be taken to allow the necessary studies to be carried out. (Maaninka 2023.)

3.4 Reporting

The problem with cost tracking can be that the invoice data and details cannot be extracted in a usable format that meets the requirements. Reporting needs to be sharp and concise. When designing the reporting and dashboard, the outcome and user-friendliness for the end-user should be considered. A dashboard should help to summarise the information in a few figures. It should be kept in mind that end users are not necessarily finance specialists, so unnecessary details and complicated charts should be avoided. (Alkula 2024.)

As the most important figures and charts Alkula mentions "Total invoicing per supplier", "Actuals year to date", and "Budget year to date". Tracking the total invoice per supplier helps to understand the whole picture, to see what kind of work and how much they have delivered for all projects in total. The great scope helps to understand the scope of costs and the status of how much of the supplier's services and costs have occurred each year. Such information can be used to try to negotiate lower-cost service purchases by knowing the expenditure. (Alkula 2024.)

It is important for project managers to see what the budget is and what the cumulative actual is, to assess whether the annual budget is sufficient and to be able to react to future costs, cash flow and possible budget exceedances. Project managers should be able to see budget variances clearly so that they can further investigate what has caused the variance. The information needs to be in a simple and understandable format. (Alkula 2024.)

4 PROJECT COST REPORT

The development task of the thesis was to create a project cost report to have an overview of the costs during the developmental phase of an onshore wind farm project. The internal project cost report was created for the project development team as well as the finance team. Project cost report was limited to project development of an onshore wind farm project; thus, construction and sale were not included. Project cost report is attached to this report (appendix 3). The content of the appendix is confidential.

4.1 VSB Uusiutuva Energia Suomi Oy

VSB Uusiutuva Energia Suomi Oy is a project developer in the field of renewable energy. VSB operates extensively in the renewable energy sector, developing wind, solar and wind-solar hybrid projects. (VSB Uusiutuva Energia Suomi Oy 2023.) VSB Uusiutuva Energia Suomi Oy was founded in 2016 and it currently employs 21 specialists. VSB Uusiutuva Energia Suomi Oy is part of an international VSB Group. VSB Group employs over 500 specialists and was founded in 1996. Group's headquarters is in Dresden, Germany. Besides Germany and Finland, VSB Group operates in France, Poland, Romania, Italy, Croatia, Greece, and Spain. The largest owner of VSB Group is Partners Group.

The company's project development is divided into four phases that vary in their duration from six months to four years. The phases have their own characteristics, criteria, and budgets. The phases have different criteria regarding such topics as design, land securing, resource assessment, permits, local consent, grid, and environment. Transferring between the phases is done in accordance with the company's internal operating models, with the decision to change phase being made by the steering committee. To transfer a project to the following phase it must meet the criteria set. As the phases progress the success rate of the project and its progress increases. The phase transfer is decided in a steering committee where the project's status is presented, and the transfer is presented to be timely in relation to the status and criteria met in the project's progress.

4.2 Choice of topic

The topic of the thesis was discussed together with the commissioner's supervisor and the project managers. The aim was to find a topic that would be interesting to research and develop and that would be helpful in the management of project costs and simplify cost monitoring. The company's current system focuses on cash liquidity planning therefore it did not meet all the needs of the project development team in terms of cost management and monitoring. It was decided that the topic of cost monitoring, cost tracking as well as cost management would be researched and a tool that met the needs would be created. The tool would show the history of the costs in one place unlike the current system in use. The tool was designed to emphasize simplicity, ease of use and fast access to data.

The project cost report and the resulting charts became part of a larger internal development project at VSB. The development team wanted to improve their current weekly meeting report base and its project information and status tabs. The project aimed to centralize access to project data and status by creating project-specific files containing the project's financial status, development status and overall project information and characteristics. Dashboards were created from the project-specific files, and they consisted of charts and summarized information. The dashboard provided a clear overview of project information and status, upcoming invoices, budget vs. actual costs, and amount of money used per project phase. Furthermore, the dashboards include a project area map, key project figures, land acquisition and permits and information regarding the municipality.

4.3 Interviews in the field

The planning and implementation of the cost reporting was supported by internal functions and interviews with two professionals in the field. The interviews included a selection of questions on the costs and management of the wind power project. The questions were tailored as needed to complement the previous theoretical base. The interviewees had the opportunity to familiarize themselves with the questions beforehand, which increased the informativeness and precision of the answers. The interviews were audio-recorded with interviewees consent to ensure that the interviews were processable, and all information was accessible. The interview questions were almost identical so that the answers and materials from the interviews could be analyzed together

and in comparison, with each other. In this way, similarities and differences between the materials could be distinguished.

The analysis of the interview content was started by transcribing the recorded interviews. After transcription, the materials were typed into the correct format. The text was critically reviewed in the light of the topic of the thesis, in particular the delimitation of the work. The interview materials were compared with the existing theoretical base on project management and costs. Where possible, the materials were integrated into categories and under headings to create a coherent and informative text. Some of the transcribed material was beyond the scope of the thesis and was therefore excluded from the thesis report. Thematic interview as an interview format and the relaxed nature of the interview setting allowed for additional questions and open discussion, bringing up important issues beyond the original questions. One of these was the characteristics of good reporting, which would have been important to include in the original questions, in retrospect.

4.4 Planning of the report

The identification of needs and development ideas for the development project was based on participatory observation through “Dashboard workshops” that started in late autumn. The project development team and other related parties held workshops regularly to assess the status and further improvements of the development project. The workshops were a practical way to discuss the report, the participants consisted of specialists with different backgrounds and expertise, which ensured discussion and ideas from different perspectives. The features of an Excel-based report were discussed with an employee who had in-depth experience in building reports and creating pivot tables. These discussions were used to establish the level of detail that was possible to achieve and to ensure that the report was created to the best possible standard from the very beginning.

After assessing the needs of the project cost report the development process started with research into existing internal cost reports, tools, and their capabilities. By examining these, the shortcomings and working features of existing tools became clear. Various reports regarding costs and project invoices can be run from the accounting system, these reports provided a foundation that could be further developed to suit one's own needs.

The creation of the report was supported by a theoretical base consisting of topics such as cost categories for industry projects, project phasing, cost management, cash flow forecasting and what characteristics good reporting has. The theoretical base for the thesis was built from project management literature, texts published by the field association and thematic interviews with professionals in the field. The theoretical base supported the planning, creation, and development of the project cost report. Another key contributor to the report was the regular workshops with the project development team, which ensured that the report met the needs of those whom it was intended for. From the interviews the author gained a wide range of perspectives on the chosen topics, concrete advice on cost management, monitoring, and reporting. The interviews also confirmed that there is not a single best way to deal with costs, there are many different practices, and they are company specific.

The project cost report was an intriguing topic to approach, given that the author is working closely with the subject and project finances. The development and implementation of the tool was smooth and flexible as the author was employed by the commissioner during the thesis process. The employment and accumulated work experience made it easier to understand what sort of tool would meet the commissioner's requirements best, and what specific needs should be considered. The creation and development of the tool was rewarding because it provided concrete support in the management of costs.

4.5 Conducting the report

The outlining of the project cost report was started by running different cost reports from the commissioner's accounting system. None of the reports met all the needs that were had but they gave a solid foundation, as the accounting system's reports contain a lot of the information needed for the final project cost report, such as vendor details, dates of invoices, and monetary amounts.

The process continued by running a report from the accounting system that had useful information to the greatest extent possible and used it as a foundation. The project cost report is based on Microsoft Excel, which contains tabs for different purposes. A "Master data" tab was created in Excel, which contained all the data needed for the pivot table and various charts. The foundation report required a great deal of modifications, it contained both unnecessary and incomplete data. For example, such information was manually added to the report:

1. Category 1
2. Category 2
3. Orderer information
4. Payment installment
5. Installment description
6. If the cost was additional work
7. Project phase
8. Fiscal year
9. Budgeted amount
10. Estimated amount.

Category 1 and 2 columns allow cost category filtering and give additional information to the type of cost. In future development the category information can be linked to commissioner's work time monitoring system, which will have similar categories allowing the allocation of work time and external costs. The similarity of the categories in the systems allows data to be aggregated and compared. By aggregating, it is known how many work hours each category requires, therefore resources can be planned and secured in advance.

The Payment installment and Installment description give insight into the cost. Description helps to keep track of large and long-lasting tasks and subtasks from external suppliers and visualize the invoicing status of the task. Tasks often have milestones for invoicing, such as "20% of payment when planning is done.". One of the needs that emerged right from the start was to monitor the additional work and understand the amount of additional work that was being done. There is always additional work involved in wind power projects, but it is not always clear nor summarized how much of the work is additional. For monitoring purposes, it is essential to know the amount of extra work in relation to tasks, project phases and suppliers. Extra work was created as a column with a drop-down list that the users could click if the cost was additional. Another essential piece of information that was needed in the report was the fiscal year. At VSB the fiscal year differentiates from the calendar year, making it necessary to create as its own column.

The project phase column was created to give an overview of the cost distribution between the phases. This data can be used to see the duration of the phases and it can be compared to the target duration of each phase. As the project can have delays and suspensions it is informative to see how they affect the duration of the phases. Adding the project phase column was a key function

that enabled the research questions to be answered. Over time and as the phases progress, project phases can be compared in relation to, for example, money, time, and the amount of additional work. The budgeted amount and estimated amount were added to the report to show the cost amount changes from the budget to the actual price. The budgeted amount shows the amount that a certain task had budgeted. The estimated amount is based on a more accurate estimate or a quotation price. The data of the changes enables a comparison of amounts and helps to estimate the prices of tasks for future projects. The comparison shows if the costs tend to be underestimated or overestimated and how big of a contingency amount is needed.

As the foundation report progressed it was made to be preliminary template for the project cost report. During the different progress stages of the report the development team had the versions of it available to see and experiment with. Since the team could experiment with the report's features independently, the input received was detailed and comprehensive. The experimentation process resulted in precise development ideas that made the updated versions of the report more user-friendly and met new needs.

Based on the master data, a Pivot table was created to make it easier to view the data. Practicality and simplicity were sought by filtering the data created in the master data, which the team and project managers may not need in their daily work, but which were necessary for the functionality of the charts and tables. Due to the scale of the projects and the duration of the project development, the Pivot table contains numerous rows and columns of data despite the filtering of the master data. To make the Pivot Table quickly accessible despite the amount of data, the author felt the best solution was to create Slicers. Slicers allowed for quick compartmentalization and filtering of data; the slicers were found to be quicker to use than traditional filters. Slicers provided a simple view of what filters are in use; thus, what data is visible at that time. Slicers were created of, among other options, vendor data, fiscal year, categories, extra work, project phase and status. Figures 4 and 5 show examples of the slicers in the project cost report.

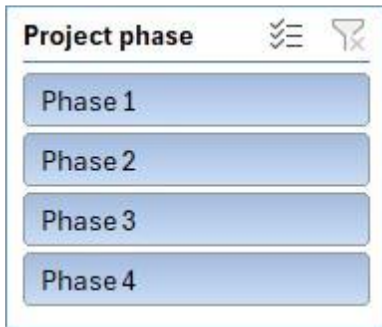


FIGURE 4. Project phase slicer in the project cost report.



FIGURE 5. Cost category 1 in the project cost report.

Based on the master data various charts were created to show summarized views of details. For the dashboard it was desired to have charts such as "Budgeted vs actual" (appendix 6), "Amount per fiscal year" (appendix 4), "Amount per project phase", "Budgeted vs Estimated vs Actual". The charts are shown in percentage form for the purpose of this thesis. Figure 6 shows the budgeted cost, estimated cost, and actual costs incurred in relation to each other during the years.

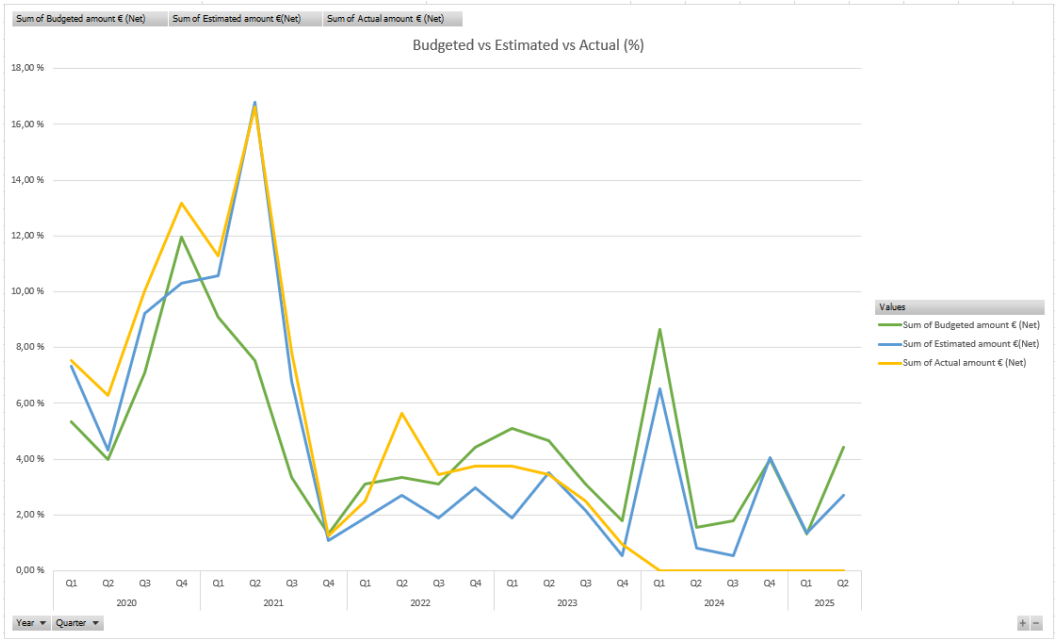


FIGURE 6. Budgeted amount, estimated amount, and actual amount of costs during the years and quarters.

Figure 7 shows the incurred amount per project phase. The distribution of costs between the different phases of the project was a particular issue of interest to the commissioner.

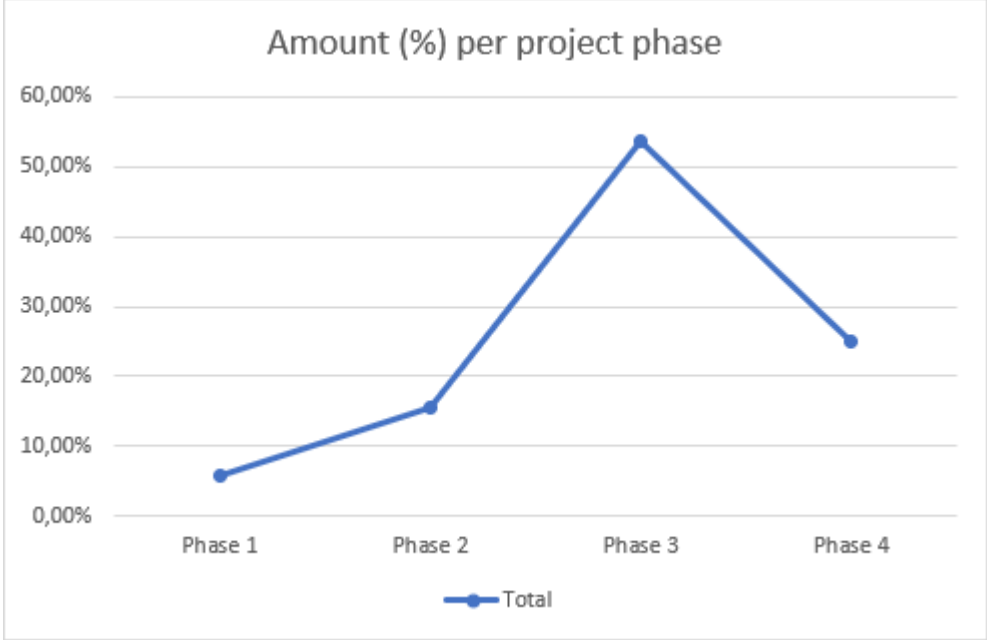


FIGURE 7. Cost distribution between the project phases.

Using the report requires manual work. When costs are estimated, they should be filled in as a cost line in the report using a price and schedule estimate. When an invoice is received in the accounting system, the final amount and due date are updated in the cost line. The recording of budgeted,

estimated, and actual amounts allows differences in amounts to be assessed and compared. This information was essential to know how much the actual amounts differed from the estimates made. The report allowed the price history to be preserved, unlike in a company's cash liquidity system, where the price estimate is replaced by updated price information.

5 CONCLUSIONS

Cost reporting can be unclear and difficult if invoice data cannot be extracted in a usable format (Alkula 2024), as was the situation at commissioning company. Reports extracted from the accounting system required quite a lot of modifications to form as a foundation for the project cost report. Manual work was required to start the reporting and to create the template. To meet the requirements and needs of the report most of them had to be added and created manually. Manual work and creation allowed the report to be exactly as wanted. From the report multiple charts were made to give an overview of different topics. The charts will be used in the project-specific dashboards.

Cost monitoring focuses on recognizing differences between budgeted costs and actual costs incurred (Mäntynevä 2016, 99). To reach a higher level of recognition of the differences, the topic was highlighted in the project cost report and especially in the charts based on it. The charts show the budgeted amount compared to the actual costs in relation to project phases, fiscal years, and quarters. In the dashboard the “Budget vs Actual” -charts give an overview and encourage the project managers to further examine cost differences which makes the monitoring more effective.

Reporting should be created in a simple and user-friendly way. The charts should be created with the end user in mind, they should not contain unnecessary details, nor be too complicated (Alkula 2024). The report was designed in a way that it answers the research questions of how much time and money it takes to complete a project phase and how the costs are distributed to the different project phase. Different features that were created to answer the questions were the charts, filters, and history of the costs. The data shows that the project phase 3 of the commissioning company has the highest costs. It is partially explained by the fact that it is the longest of the phases. The budgeted amount and actual amount per project phase can be seen in appendix 5, which shows phase 3 having the highest budget and actual costs incurred. The question that the project cost report could not answer at this stage was how many internal work hours were required for the different tasks and project phases. There was not enough accurate data available on the work hours over a long enough period to be able to allocate them to specific tasks. This remains an issue for further development work, which will be an interesting area to explore during the spring.

There are differences in how costs are distributed between the different phases of a project. The distribution varies from company to company and even from project to project. The biggest difference comes from the way the project is phased. Maaninka (2023) divides the project development into three phases, the middle of which contains large payment items and is thus the most expensive (Maaninka 2023). The commissioning company divides the project development into four phases, of which the third is the longest and the costliest.

Regularity is central to monitoring and forecasting costs (Maaninka 2023). Monitoring should be based on timely information (Pelin 2020, 172) and include all parties that generate costs (Kerzner 2013, 630). In the commissioning company, costs are monitored and forecasted monthly, focusing on the following months. The commissioner's policy within cost monitoring and forecasting is effective and regular but the current system does not meet the needs. With the project cost report implemented, those incurring the costs enter the estimated cost in the report, the cost entry is updated when more information is available or when it is more accurate. This practice ensures that costs are both anticipated and updated as they are monitored.

There is a general lack of automation for cost forecasting or monitoring. Cost management and cash flow forecasting requires manual effort from the parties involved. Cost management can be time-consuming and seen as difficult especially if the systems in use are not flexible or if one system does not meet all needs and management involves multiple systems. The commissioner's current cost forecasting system faces several challenges. The system does not provide an overview of the costs of the whole development phase. Costs are divided into top-level phases, which is essential for the management of the whole project but does not serve the project development phase at the level that the project development team needs.

Differences arise when considering the common theory of budget overruns and how to try to prevent them. In this particular field, where there are often interruptions and delays in project development, going over budget can even be seen as a positive thing, the project progresses and costs are incurred. However, budgets usually have enough contingency to avoid overruns, and budget needs to be able to react to unexpected changes and delays to ensure that the budget is not exceeded.

6 REFLECTIONS

The implementation of the thesis fulfilled goals that were set in the beginning of the process. It increased my expertise in cost forecasting, monitoring, and management. I learned elements of a practical and informative report and was able to create a functional report for the commissioner. The project cost report also strengthened my Excel skills, from data processing to creating various pivot tables and charts. The topic of the thesis was relevant and interesting to research. The development task challenged my skills and was overall a truly instructive process. The knowledge and skills learnt will be of great importance for ongoing work and further development of the report.

Furthermore, the commissioner received a concrete tool that meets their needs and wishes. The report gives the commissioner a broad picture of the cost distribution, which helps prioritize resources between projects. Understanding the cost distribution can be used to evaluate the transfer of project phases. A general awareness of the costs in relation to tasks and suppliers provides leverage in future negotiations. Additional work that is regularly ordered can be included in the original service contract in the future, which is expected to be cheaper than contracting extra work.

Working with the commissioning company was fluent and I received support and advice during the process. The employees were interested and motivated to help develop a tool that they will use, and which responds to their needs. During the process, ideas for further refinement emerged, the biggest of which is the inclusion of work hours in the report to keep track of how many internal work hours are required for tasks and project phases.

The thesis process started in spring 2023 and the initial discussion with the supervisor was held in May. The theoretical base for the thesis was created during the summer and early autumn. After the guidance seminar, the project cost report and the thesis report were produced overlapping during the rest of the autumn. During the thesis work process there were unexpected scheduling changes that delayed the empirical part of the work, but the changes were accommodated flexibly and to the best of my ability.

6.1 Further development

During the thesis process, ideas for further development and refinement of the project cost portal emerged. Development ideas are expected to arise with the use of the report over time. The report will be adapted from ideas and changes in the commissioner's practices and procedures.

A guide for using the project cost report will be created to inform users of the features of the report. The guide is written to be understood by anyone. The creation of the guide is crucial for business continuity, it ensures that the skills to use the report are guaranteed despite possible personnel changes. As the end user of the report is the project development team and the finance team, the report is handled by several users which emphasizes the need for a shared user guide to ensure consistency of use and operation.

The project cost report is intended to include the hours worked by the employees and therefore the value and amount of their own work. During the thesis process, it was found that the current available data for tracking hours is not sufficiently accurate. There is no task or category specific data on work hours. A new system is being implemented in the commissioning company to provide the necessary data. The tracking of hours worked will be linked to the report by categories. In the new system the hours recorded will be assigned to a project and a task from a pre-agreed set of task categories. The categories of the system have been selected with the consideration of linking the work hours to the project cost report. The new, accurate work time monitoring system will be implemented in the commissioning company in January 2024.

Project cost report will be implemented to all commissioner's wind projects using the template, the process has already begun and will continue during the spring.

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Interview on the costs of a wind power project

1. What are the costs/cost categories of an onshore wind power project?
2. How are the costs distributed over the different phases of the project development?
Can they be divided into different phases?
 - a. How do the different phases differ in length, amount of work and costs?
3. Are there any specific characteristics of the phases, what are they?
4. How do the costs change in terms of quantity and content over the length of a project?
 - a. Does the length of a project create risks for budgeting and if it does, what kind of risks?
 - b. How can the budgeting risks be avoided?
5. Is there anything specific to consider in terms of costs and their monitoring, given the length of projects?
6. Which phases or work packages of the project development require the most man-hours?
7. Is there anything specific in the cost/cost categories of a wind project?
8. How are costs monitored and controlled?
9. What are the risks/problems in monitoring/pre-establishing costs?
10. What issues can cause changes in costs? Internal or external.
 - a. Is there often a need for additional work during the project development phase? How do they affect costs, forecasting and management?
11. How does the nature of projects affect costs? For example, the riskiness of projects.
12. How can cash flow be predicted and monitored in the most efficient way?

Interview on the costs of a wind power project

1. What are the cost/cost categories of an onshore wind power project?
2. How are costs distributed over the different phases of project development? Can they be broken down into different phases?
 - a. How do the different phases differ in length, amount of work and cost/volume?
3. Are there any characteristics or criteria for the different phases, what are they?
4. What is the budgeting process for project development costs? Are there many changes in costs (price changes, legal changes)?
 - a. How can budgeting risks be avoided?
5. Is there often a need for additional work during the project development phase? How are they anticipated and what is their impact?
6. How do changes in costs affect forecasting and management?
7. Which phases or work packages of project development require the most man-hours?
8. How are costs monitored and controlled?
9. What are the risks and problems associated with cost monitoring and forecasting?
10. How can cash flow be predicted and monitored in the most efficient way?

CONFIDENTIAL APPENDIX

