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Optimization of project management tools and internal processes

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Description

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Abstract

This thesis explores theories and methodologies aimed at improving the project management process and internal tools of a case study company facing the necessity for renewal due to the expansion of its activities.

The study is divided into three main areas. First, it addresses the improvement of the primary project management process, with a focus on the implementation of Lean and Agile methodologies, presented as a blend of both, applied to project management activities. The second area focuses on enhancing the tools and techniques used in the company's monitoring and control processes. The third and final area involves the automation of project reporting to reduce the time spent on reporting activities.

This thesis employs qualitative methods, including company data collection, daily interactions with personnel, semi-structured interviews, and theoretical research. The results include a new project management process for the company, the selection and standardization of tools and techniques for monitoring and control activities, and the automation of reports generated by the project management department. In conclusion, this thesis is beneficial not only for addressing the specific needs of the case study company but also for providing guidance to anyone seeking to improve their project management processes and activities.

Keywords/tags (subjects)

Lean methodology, Agile methodology, project management tools, project reporting, Microsoft Automation, project process, Project monitoring and control.

Miscellaneous (Confidential information)

Annexes A, B, C y D must be kept secret and have been removed from public work. The basis for confidentiality is the Publicity Act 621/1999 24 §, Sections 17 business or professional secrets. The confidentiality period is five (5) years, the confidentiality ends on the 07.07.2029.

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Kuvailulehti

Sotello G. Pauline

Projektinhallinnan työkalujen ja sisäisten prosessien optimointi

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Tiivistelmä

Tässä opinnäytetyössä tarkastellaan teorioita ja menetelmiä, joilla pyritään parantamaan tapaustutkimusyrityksen toiminnan laajenemisen vuoksi uudistamistarpeessa olevaa projektinhallintaprosessia ja sisäisiä työkaluja.

Tutkimus on jaettu kolmeen pääalueeseen. Ensimmäinen käsittelee ensisijaisen projektinhallintaprosessin parantamista keskittyen Lean- ja Agile-menetelmien käyttöönottoon, jotka esitetään molempien yhdistelmänä ja joita sovelletaan projektinhallintatoimintoihin. Toinen alue keskittyy yrityksen valvonta- ja ohjausprosessien työkalujen ja tekniikoiden parantamiseen. Kolmas ja viimeinen osa-alue on projektiraportoinnin automatisointi, jolla vähennetään raportointiin kuluvaa aikaa.

Tässä opinnäytetyössä käytetään laadullisia menetelmiä, kuten yrityksen tiedonkeruuta, päivittäistä vuorovaikutusta henkilöstön kanssa, teemahaastatteluja ja teoreettista tutkimusta. Lopputulos sisältää yrityksen uuden projektinhallintaprosessin, seurannan ja hallinnan työkalujen ja tekniikoiden valinnan ja standardisoinnin, sekä projektinhallintaosaston tuottamien raporttien automatisoinnin. Yhteenvetona voidaan todeta, että tämä opinnäytetyö on hyödyllinen paitsi tapaustutkimusyrityksen erityistarpeiden käsittelemiseksi, myös opastuksen tarjoamiseksi kaikille, jotka haluavat parantaa projektinhallintaprosessejaan ja -toimintojaan.

Avainsanat (asiasanat)

Lean-metodologia, Agile metodologia, projektinhallintatyökalut, projektiraportointi, Microsoft Automaation, projektiprosessi, projektin seuranta ja ohjaus.

Muut tiedot (salassa pidettävät liitteet)

Liitteet A, B, C y D on pidettävä salassa ja ne on poistettava julkisesta työstä. Salassapitoperusteena on julkisuuslaki 621/1999 24 §, 17 § liike- tai ammattisalaisuudet. Salassapitoaika on viisi (5) vuotta, salassapitoaika päättyy 7.7.2029.

Contents

1 Introduction 4

2 Research design 6

2.1 Research problem. 6

2.2 Research questions. 6

2.3 Scope and limitations 7

2.4 Research environment. 7

2.5 Research Methods 8

2.5.1 Data collection and data analysis 9

2.6 Information retrieval and source material 12

2.7 Structure of the thesis 13

3 Project management methodologies 13

3.1 Lean Methodology 14

3.2 Agile methodology 14

3.3 Blending methodologies 16

4 Project management Processes 20

4.1 Type of processes 20

4.2 Monitoring and control processes 23

4.2.1 Components of project Control 24

4.2.2 Schedule Control 25

4.2.3 Cost Control 26

4.2.4 Quality Control 27

4.2.5 Productivity Control 27

4.3 Tools and techniques used in Monitor and control processes. 28

5 Project reporting 30

5.1 Frequency of reports 31

5.2 Time spent in report execution. 32

5.3 Automation in Microsoft office tools 33

6 Implementation 38

6.1 Section 1: Project management process 40

6.1.1 Overview project management process 40

6.1.2 Developing a new process 42

6.1.3 Implementation of lean and agile methodologies over the project management process 45

6.2 Section 2: Selection of tools and techniques 46

6.2.1 Identification current tools and techniques used 46
6.2.2 Selection of tools and techniques 58
6.3 Section 3: Project management reports 67
6.3.1 Presentation of previous formats 67
6.3.2 Presentation of new formats 69
6.3.3 Reports automation 72
6.3.3.1 Reminders 73
7 Results / Analysis 73
7.1 Analysis post implementation 73
7.2 Reliability 75
7.3 Research ethics 75
8 Conclusions and discussions 75
8.1 Theoretical and practical results integration 75
8.2 Addressing research questions 76
8.3 Conclusions 76
8.3 Suggestions 77
9 References 78
Appendices 80
Appendix 1. HLP Check List 80
Appendix 2. HIGH LEVEL PLAN (HLP) Major projects 81
Appendix 3. HIGH LEVEL PLAN (HLP) Medium projects 83
Appendix 4. HIGH LEVEL PLAN (HLP) Small projects 85
Appendix 5. FEASIBILITY CHECK LIST 87

Figures

Figure 2-1. Project organization. 8
Figure 2-2. Structure of the thesis. 13
Figure 3-1. VSM example. (Syed, 2023) 17
Figure 3-2. Agile iterative Process example. (fullstackenergy, n.d.) 18
Figure 3-3. Scrum vs Kanban Board examples. (premierAgile, n.d.) 18
Figure 3-4. Lean/Agile Steps. 20
Figure 4-1. The project management process involved with project control. 24
Figure 5-1. Linked Information in a Word document from and excel source data. 34
Figure 5-2. selection of data from Excel sheet. 35
Figure 5-3. Selection in destination of Paste special. 36

Figure 5-4. Linking display. 36
Figure 5-5. Screen of selection on data for modifying the source. 37
Figure 5-6. Notification of actualization of data. 37
Figure 5-7. Break or modify the link step 1 38
Figure 5-8 Break or modify the link step 2. 38
Figure 6-1. Implementation project management process. 39
Figure 6-2. Implementation selection of toos and techniques 39
Figure 6-3. Implementation reports automation 40
Figure 6-4. Project complexity chartflow 41
Figure 6-5 Original Process path 41
Figure 6-6. New project management process 43
Figure 6-7. Process flow in HLP 45
Figure 6-8 Change management original 48
Figure 6-9 Risk Register project 2 49
Figure 6-10 Rankin severity project 2 50
Figure 6-11 Risk register Project 3 50
Figure 6-12 Risk instructions Project 3 51
Figure 6-13 Procurement project 1 and 2 52
Figure 6-14 Procurement Project 3 52
Figure 6-15 Schedule Project 1 53
Figure 6-16 Procurement schedule project 2 54
Figure 6-17 Design schedule project 2 54
Figure 6-18 Main schedule project 2 55
Figure 6-19 Procurement schedule project 3 56
Figure 6-20 Design schedule project 3 56
Figure 6-21 Main schedule project 3 56
Figure 6-22 Budget format all projects 57
Figure 6-23 Issue Log tracking 59

Tables

Table 2-1 Data collection 9
Table 2-2 Detail of interviews 10
Table 2-3 Interview topics 11
Table 4-1. Management Processes. (Burke, 2009) 21

Table 0-1 Questions Interviews ..... **Error! Bookmark not defined.**

1 Introduction

Biovoima Oy is a privet owned cleantech company, based in Jyväskylä Finland founded in 2014, the company use to operate as a sales partner for a few technology suppliers in the field of Biogas; In 2018 the company started to do their own designs- engineering, and R&D. Recently the company has started as a EPC provider, expanding their operations, nowadays, the company is in the need of restructure the project management processes and enhance the tools used in the department of Project management.

Through this thesis is going to be review the interaction between the lean and agile methodologies, reviewing the processes involve in the project management, aiming to create a process

where both methodologies co-work, focusing on the monitoring and controlling of projects; Biovoima Oy being a company in current expansion needs processes and tools ready to be adaptable to the necessities.

Lean management in one hand has been a methodology used for companies for over 70 years, this methodical examination of procedures and values chains aimed at minimizing waste, inconsistency, and rigidity enhances effectiveness in managing cost, improving product quality, enhancing customer satisfaction, and fostering employee involvement, frequently all at once.

in the other hand, agile methodology is more recent, originated in the 90's and followed in 2001 by the release of the "Agile manifesto"; follow a different approach, being quicker and more flexible. Agile advocate for a cyclic approach to development, prioritizing he swift delivery of an initial prototype of a new product or service to customers, subsequently, teams gather feedback and undergo rapid iterations, continuously refining the product or service over time. (Raedemaecker, Handscomb, Jautelat, Rodriguez, & Wienke, 2020)

Building a common mindset of those theories will guide the company to a more flexible process in PM; monitoring and controlling processing can be an extensive and rigid part of the PM processes, however, is as less, the most important of all, if is compared to other processes which serve more as project elucidating.

The monitoring and control processes will give us the track and ensuring appropriate standards and deadlines are met; the collection and understanding of information about the project will give the require instruments to take the right and opportune actions along the projects. This information however, tent to be time consuming if it is analyzed individually, for example, cost analysis, schedule or risk analysis led to not give and overall view of the project, even though the tools are used for control, this is the reason why the reporting tools are used for summarizing this data, giving a more simply and explicit way of visualizing the status of projects.

2 Research design

2.1 Research problem.

Biovoima Oy being a company facing a grow up in their operations, creates a necessity to improve the internal project management processes and tools.

Currently the project management process is not being enough Aline with the new necessities o with the internal evolution of the quality managing systems, company is acquiring new personnel and expanding the amount of projects in the portfolio, which made more convoluted the project management control and monitoring, based mainly on the tools and techniques used for following and reporting, being the last one the most precarious due to the lack of aliment between the project managers.

Each of the project managers is controlling and monitoring and reporting with similar but different formats of tools and techniques, making more complex the summarizing of data of weekly, monthly, and other itinerant reports, as well as incrementing the time spent on it.

2.2 Research questions.

Based on the current necessity of Biovoima Oy, this study will focus on solve the followed questions:

- How can the company unify the tools and techniques used in project management?
- How can the company improve the time of project reporting?

The logical answers to these questions are sought in this research.

The primary objective of the first study question is to determinate how the tools and techniques used in PM monitoring and control can be unified, in theory the list of tools used for the purpose is extensive but the key to selection of this tools and techniques is based on the necessities and methodologies of the company, this will lead to an analysis of the current process implemented, and based on the evolution that is facing currently the company, this research is figuring out the

right modifications of the processes to align with the current status and hence the right selection of tools and techniques to be presented to the project management team.

The secondary research question bases its development in the control and monitoring process of the project management process, where the effectiveness of reporting is the key but as well the challenge due to the predicament of being a time consuming task in PM. Documental control, data management, clear presentation of project status and automatization of activities will be the main actions to develop aiming to solve the predicament expose in the question.

2.3 Scope and limitations

The scope of this study aims to improve the project management process by identifying the tools and techniques related to monitoring and control processes in project management. It will create new standardized formats for these tools and techniques, using the knowledge and theories mentioned in this study, and implement automation in the project reports used in the project management department.

The study presents the followed limitations:

- To limit the number of tools involved in this research-based project, the study will focus only on the tools used in control and monitoring, from the project management processes.
- This research will not extend in the theory behind each control and monitoring techniques but will cover the sustentation of its selection.
- This study will apply specifically for the necessities of Biovoima Oy, however is not a limitans to be used as an example model for other companies.
- Access to data is limited to only 3 of the company's projects, restricting the potential for comparisons.

2.4 Research environment.

This study will be conducted in the context of the engineering industry, with a focus on project management practices in Biovoima Oy; The target population will consist of Leader of Project manager, project managers, and other professionals involved in project management activities in

these organization from other departments as procurement, quality management, design management, between others.

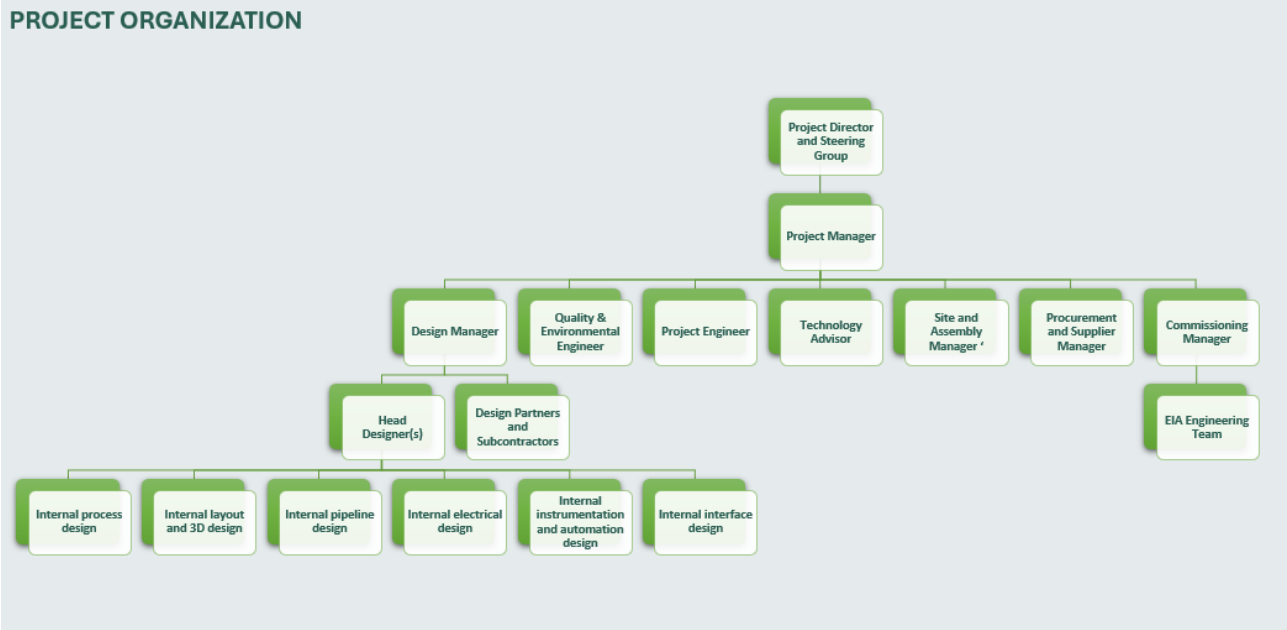


Figure 2-1. Project organization.

2.5 Research Methods

Research methods encompass the approaches and procedures employed in gathering and analyzing data to address research inquiries and fulfill research aims. Selecting appropriate research methods is crucial for the effectiveness of a research endeavor, as it dictates the nature and caliber of the data gathered, along with the trustworthiness and accuracy of the conclusions.

Qualitative methodology is a research approach focused on understanding human behavior, perceptions, and experiences in depth. It emphasizes subjective interpretations, context, and the exploration of complex phenomena. This methodology relies on methods such as interviews, observations, and analysis of texts to gather rich, descriptive data. Qualitative researchers often seek to uncover patterns, themes, and meanings within their data rather than quantifying variables. All qualitative research methodologies start from the premise that social researchers operate within subjective contexts and cannot assert a position of neutral or scientific objectivity. (Davies, 2007)

To gather the required information to conduct this assessment, project managers and project team will be participating in semi-structured interviews. the purpose of this interviews is to obtain their perspectives and opinions about the current processes of PM, the status of control and monitoring activities, the tools used on it and the difficulties presented during the reports.

Literature review method will be used as support on the theories behind the subjects to be analyze and developed during the report, supporting in the evaluation of the PM processes and the modifications to be implemented in processes and tools used in the PM control and reporting.

2.5.1 Data collection and data analysis

Data collection and analysis in this study are conducted using qualitative methods, such as documentation analysis, observations, and interviews. This contrasts with a quantitative approach, which focuses on numerical data. Data for this study is collected from three main sources, which are presented in Table 2-1 below.

Table 2-1 Data collection

Interview and discussions	Internal documents	Observations
• **Semi-structured interviews with people involved in project deliveries** • **Meetings** • Informal discussions	• Process descriptions • Projects documentation • Reports	• The expertise of personnel was utilized for identifying and solving the problem in this study.

Table 2-1 shows that the primary sources of data in this study included: (a) the interviews and discussions, (b) internal documents, and (c) participant observations by the researcher.

a) Interviews and discussions: Opportunities to collect data included interviews and discussions during various meetings, such as project team meetings, business unit meetings, and other regular meetings, as well as informal discussions with individuals involved in project

functions within company. A summary of details related to semi-structured interviews, including information about participants, projects, interview dates, and forms of documentation, is presented in Table 2-2 below.

Table 2-2 Detail of interviews

Person	Role	Date	Documented as
1	Procurement Manager	08.05.2024	Recording, Transcription, and field notes
2	Quality and environmental Engineer	08.05.2024	Recording, Transcription, and field notes
3	Sales Manager	08.05.2024	Recording, Transcription, and field notes
4	Design and engineering Manager	10.05.2024	Recording, Transcription, and field notes
5	Sales calculation engineer	13.05.2024	Recording, Transcription, and field notes
6	Project Manager	13.05.2024	Recording, Transcription, and field notes
7	Project Manager Leader	15.05.2024	Recording, Transcription, and field notes

The interviews were conducted to 7 members of the company related directly to project delivery activities; the transcriptions of the interviews are visible in **Error! Reference source not found.**". The interviews, meetings and discussions were conducted face-to-face and via Teams meetings, the participants were prepared to the event beforehand by presenting the topics as described in Table 2-3 below.

Table 2-3 Interview topics

Topics
Project management process
Methodologies used by the company in PM process
Tools and techniques
Reports
Relation between departments
Free topic(s)

Table 2-3 show the main topics discussed, list of the detail questions are also included in **Error! Reference source not found.**, the main point of interviews were to identify the existing processes and the interaction between departments in the elaboration of activities related to project deliveries, in the interviews was possible to identify the level of knowledge and understanding over techniques, tools used and the methodologies which has been implemented as far and before the implementation of this thesis.

In the interviews participants were encouraged to speak freely about the topics and include their own thoughts about it, based in their experiences and educational backgrounds, avoiding any kind of interruptions or dissertations over their thoughts, aiming to leave a clear path to understand the current company status over the topics mentioned above.

b) Internal documents : A number of internal documents were analyzed for the current state analysis. More than 45 documents were reviewed and considered for this study, encompassing three different projects of the company. These documents covered various topics,

including company processes, budget, cost control, procurement, risk management, change management, reports, and project management.

c) Participant observations by the researcher: This includes all observations made in various project contexts. Such observations emerged, for example, during events not specifically intended to discover problems in the area of this study but generally within the project delivery context. Typical events included training sessions and project-specific workshops. Therefore, the observations are composed of pieces of information gathered from different contexts within the project delivery business in the case company.

2.6 Information retrieval and source material

This study will be utilizing a combination of primary and secondary sources of information to address the research questions. The primary source will include academic literature, reports, articles from reputable organizations, and any other material available on internet, as well as the knowledge and support material acquired during the master thesis studies, originated in the lectures of project planning, Project management and agile methods, Quality and risk management, managerial Accounting, Purchasing management and leadership dynamics, to help to support the development of the theoretical part in order to accomplish the solution of the questions presented.

The secondary sources will be the conduction of semi- structured interviews with the project managers and the project team; these interviews will give us a view from the personnel about the department status, the working processes and the problematics inquired in this study, as well as an opinion on the implementation to be made.

Moreover, the use of the project documentation available from recent or active projects as a source of comparative tools between the project managers to develop the improvement on them and the desire standardization of it, this will include Excel documents, Word documents, PowerPoints and other formats used in the company.

2.7 Structure of the thesis

This thesis reviews Lean and Agile methodologies and show a blending of the methodologies and how can be and interaction of them, with the objective of optimize the Project management processes of Biovoima Oy., clarifying in the road a more desirable approach to the control and monitoring processes of the department. Once that internal processes are clarify and optimized, this study will continue with the selection of the tools to be use in the project reporting and they will be optimized and become more automated minimizing in that sense the time spent on project reporting. Finally, this thesis will summarize the results of the implementation and give conclusion and discussions over it.

The conceptual framework used for this research has been given in Figure 2-2.

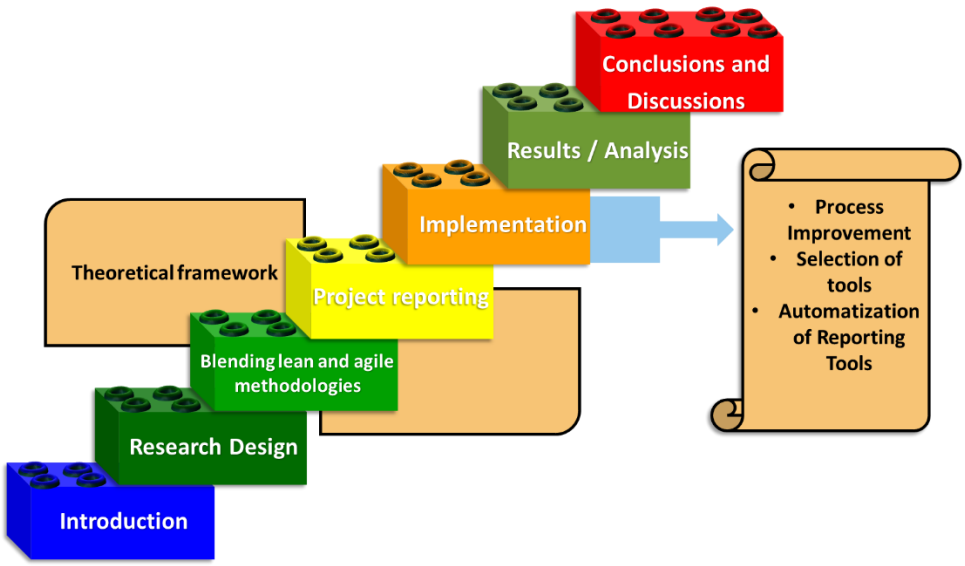


Figure 2-2. Structure of the thesis.

3 Project management methodologies

Before implementing Lean or Agile methodologies into project management, is necessary to understand the core of each one.

3.1 Lean Methodology

In basis Lean is a methodology originated from the Toyota Product System (TPS). that focused on maximizing value while minimizing waste. Lean methodology is divided into principles, tools and practices; the key principles of Lean are Value, Valeu stream, flow, pull and perfection; The tools are between others 5S's, MIFA, 3 MU's, 5WS/1H, 4M's and SDCA-PDCA cycles; these tools are used for lean diagnostic, problem solving and continuous improvement; The practices, are activities you can do once or repeatedly in a process, for example the single minute exchange of die (SMED), cellular lay out and flow, and Kanban. The combination of principles, tools and practices will give us as a result our own best processes. (Carroll, 2008, p. 113)

As a part of the methodology Lean identifies 8 main types of wastes:

- Overproduction.
- Waiting.
- Unnecessary transportation.
- Overprocessing.
- Excess of inventory.
- Defects.
- Underutilized talent.
- Motion.

However new approaches to the methodology had added a 9th waste category "employe behavior". (Charron, Harrington, Voehl, & Wiggin, 2015, pp. 164-165). By identifying these wastes, organizations can improve efficiency, quality, and customer satisfaction.

Overall, Lean is about creating value for customers by optimizing process, reducing waste, and fostering a culture of continuous improvement, it emphasizes the importance of understanding customer need, streaming operations, and empowering employees to drive positive change.

3.2 Agile methodology

Agile is not a single methodology but rather an umbrella term that encompasses several iterative and incremental approaches to software development and project management. However, when people refer to "agile methodology", they often mean one of the specific agile framework or

methodologies commonly used in the industry. Some of the most popular agile methodologies include Scrum, Kanban, extreme programing (XP), Lean software development, Crystal, Dynamic system development method (DSDM), feature Driven development (FDD) and additive software development (ASD). (Podżorska, 2022)

Each agile methodology as it own set of practices, roles, and ceremonies, but they all share common values such as costumer collaboration, flexibility, transparency, and delivering value products, and ultimately meet customer needs more effectively.

Agile as it roots in the manifesto for agile software development where the values were expressed as: (Beck, et al., 2001)

- Individuals and interactions over processes and tools.
- Working software over comprehensive documentation.
- Customer collaboration over contract negotiations.
- Responding to change over following a plan.

As well agile possess 12 principles that were based on the agile manifesto: (Beck, et al., 2001)

- “Our highest priority is to satisfy the customer through the early and continuous delivery of valuable software.”
- “Welcome changing requirements, even late in development. Agile processes harness change for the customer’s competitive advantage.”
- “Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.”
- “Businesspeople and developers must work together daily throughout the project.”
- “Build projects around motivated individuals. Give them the environment and support they need and trust them to get the job done.”
- “The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.”
- “Working software is the primary measure of progress.”

- "Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely."

- "Continuous attention to technical excellence and good design enhances agility."
- "Simplicity–the art of maximizing the amount of work not done–is essential."

- "The best architectures, requirements, and designs emerge from self-organizing teams."
- "At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly."

3.3 Blending methodologies

Blending Lean and agile methodologies can be highly beneficial as they complement each other strengths; this could be done through the principles and practices blend by:

- **Focus on the value:**

Lean principles highlight the understanding and delivery customer value while agile prioritize product that meets customers need. It means to focus any analysis or improvement only on the product of services that customer will require. Pre-setting and hypothetically approach by thinking "if we were customers of this product/project, would we be willing to pay for it?".

Using Lean's value stream mapping techniques will give a visualization to the end-to-end process of delivering value to customers based on their requirements, added to it agile practices as sprints reviews to present work, sprint retrospectives, the practice of regular meetings and burndown charts will give excellent sources of information to identify the waste and inefficiency in the processes.

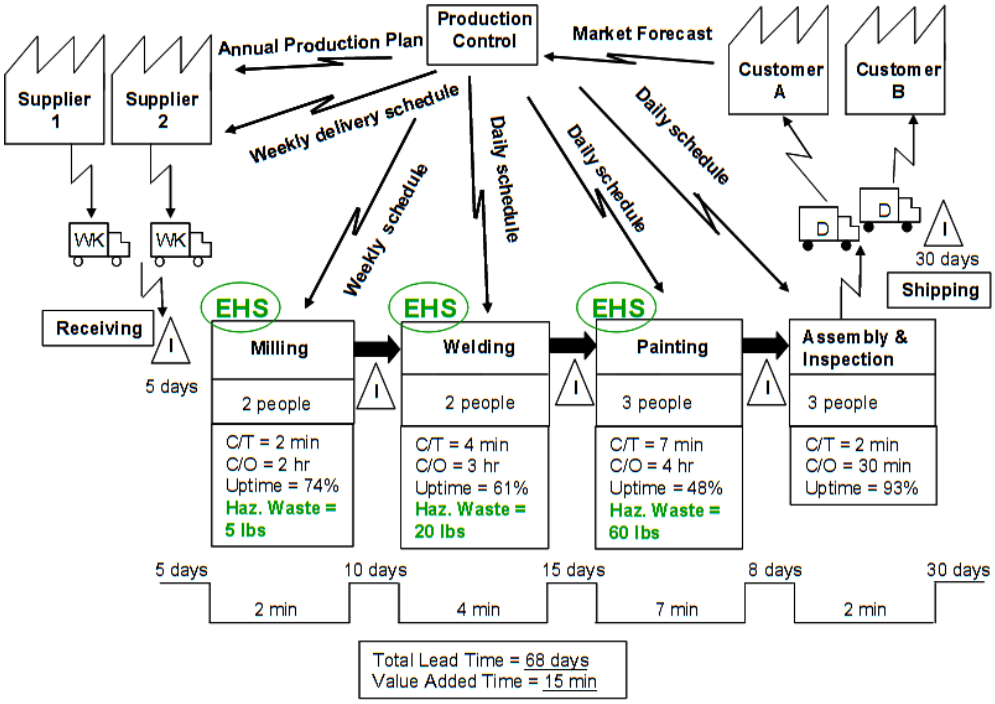


Figure 3-1. VSM example. (Syed, 2023)

- **Iterative development:**

Adopting Agile's iterative approach to development, where the work to be done is broken down into small, manageable sprints/iterations. In agile iterations, tasks are iterated continuously until reaching an ideal outcome, this facilitates the prompt identifications and mitigation of risk factors by teams before they become significant issues. Every iteration aims to enhance upon the previous one, whether by resolving bugs, enhancing existing features, or introducing new ones, this iteration continuous until the product/project is deemed ready for release. (Wrikie)

By implementing Leans concepts of continuous improvement (Kaisen), teams can reflect on each iteration and identify opportunities for further optimization and waste reduction.

Figure 3-2. Agile iterative Process example. (fullstackenergy, n.d.)

- **Waste elimination:**

Lean's principle of waste elimination can be applied into Agile's processes, the identification and elimination of non-value activities such a waiting, defects, overproduction, and unnecessary handoffs. Once again with the aid of agile practices as retrospectives or process retrospectives used regularly is possible to identify areas of waste and inefficiency.

- **Visual management:**

Implementing visual management techniques such as Kanban boards to visualize work and workflow; this on will help to identify bottlenecks, WIP and Optimize task boards will cover the same purpose as kanban, all depends in the level of detail that the team want to follow during the process and as well the flexibility of changes of the project.

Figure 3-3. Scrum vs Kanban Board examples. (premierAgile, n.d.)

- **Continuous improvement:**

The utilization of Lean's renowned PDCA (Plan, do, Check, Act) cycle and Agile's iterative "Inspect and adapt" philosophy, serves as a guiding, driving to continuously assess and refine operation at any level of the organization. Through meticulous planning, fearless execution, through evaluation and decisive action, we perpetuate a cycle of improvement that propels towards ever-higher standards of excellence.

By seamlessly blending the best practices of Lean and Agile, we cultivate a culture where innovation flourish, adaptability thrives, and continuous improvement becomes not just a goal, but a way of life This integrated approach not only enhances operational efficiency but also ensures that we remain Agile and responsive in an ever-evolving landscape, poised to meet the challenges of tomorrow with confidences and resilience.

- **Empowered teams:**

Self-organizing teams are empowered to make decision and take ownership of their work, with a focus on the importance of cross-functional collaboration emphasizes by agile methodologies. The principles of Lean, characterized by respect for people and empowerment, encourage teams to take initiative, experiment with new ideas, and continuously seek opportunities for improvement.

- **Customer Focus:**

Prioritize customer engagement at every stage of the development lifecycle, seek input early and frequently to gather feedback, validate assumptions, and ensure alignment with their evolving needs and expectations.

Incorporating Agile practices enables to streamline this feedback loop effectively. Through techniques like user stories and acceptance criteria, we meticulously capture customer requirements and expectation, ensuring a comprehensive understanding of their desires. Frequent demos serve as pivotal touchpoints, allowing to showcase progress and gather real-time feedback from customers, thereby fostering a collaborative and iterative development process.

By weaving customers feedback into the fabric of our development methodology, we not only enhance the quality and relevance of our deliverables but also cultivate strong relationship

built on trust and transparency. This customer centric approach not only ensures the successful delivery of solutions that resonate with their needs, but also positions us as responsive partners dedicated to their satisfaction and success.

By Blending Lean and Agile methodologies, it can be created a holistic approach to delivering value to customers while continuously improving efficiency and effectiveness a cross your organization. tailor the blend to suit your specific context, culture, and objectives, and be open to evolving your practices time based on feedback and learning.

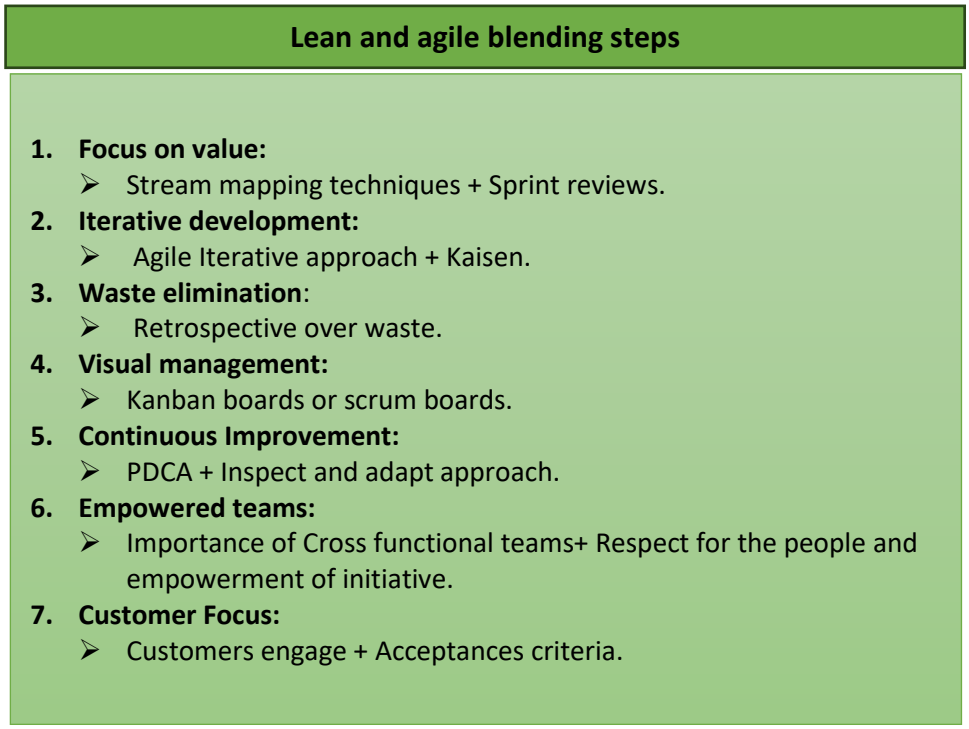


Figure 3-4. Lean/Agile Steps.

4 Project management Processes

4.1 Type of processes

Lean and Agile methodologies do not dictate a specific project management process but rather provide principles and framework that can be adapted and integrated into various project management processes. Taking into consideration that every outcome is the result of a process, say it, in PM various types of processes are used to initiate, plan execute, monitor, control and close project phases effectively.

The challenge of project management lies in the clarification of the confusion between a project phase, a project process, and a project plan. It is particularly important, as the project processes may be utilized to manage a project phase, and a project plan may be utilized to manage a sub-process. There are numerous ingenious ways in which phases, processes, and plans can be embedded within each other. These processes are typically organized into processes groups and knowledge areas in frameworks such as the Project Management Process (PMBOK), the APM BOK project management processes or even the Eastonian Process. (Burke, 2009, pp. 50-51)

Eastonian Process	APM Bok Project Management Process	PMBOK Project Management Process
Input	Starting and initiating	Initiating
Process	Defining and planning	Planning
Output	Monitoring and controlling	Execution
	Learning and closing	Monitoring and controlling
		Closing

Table 4-1. Management Processes. (Burke, 2009)

Following the PMBOK project management process approach we can define each key process as:

- **Initiating process:**

Authorize the project or phase, defining its objectives and establishing initial scope along with stakeholders' expectations, are crucially undertaken. Examples of such processes encompass the development of the project charter, identification of stakeholders, and project selection. The initiating process, which entails making the go/no-go decisions to commence the project, grants authorization to the project manager for initiating the work and utilizing company resources, including the assigned budget. At the project level, the utilization of the project charter to define the project objectives and strategies for their achievement is encompassed within this process.

- **Planning Process:**

Cover defining project scope, objectives, deliverables, and activities, as well as developing plans to direct project execution, monitoring, and control, are undertaken. This includes activities such as scope management, schedule development, cost estimation, and risk management planning. The planning process involves the development of the optimal course of action to achieve the stated scope of work and objectives (deliverables) for which the project is undertaken. Integration of all knowledge areas and iterative planning processes contribute to the formulation of an optimal project plan or baseline plan.

- **Execution Process:**

Involving the coordination of people and resources to implement the project plan and generate project deliverables are engaged in. This encompasses activities such as procurement management, team development, quality assurance, and communication management. The execution process, which issues instructions and coordinates the workforce to execute the project according to the project plan, construction method, and execution strategy, is integral to this phase.

- **Monitoring and control Process:**

Monitor project performance, identify deviations from the plan, and implement corrective measures to maintain project alignment are involved. Examples include scope verification, schedule control, cost control, quality control, risk monitoring, and change control. The controlling process, which ensures the project's progress towards objectives by regularly monitoring and measuring progress to detect any deviations from the project plan and taking requisite corrective action, is essential in this regard.

- **Closing Process:**

Formalize the completion of the project, secure acceptance of project deliverables from stakeholders, and transfer project products, services, or results to the appropriate parties are conducted. Examples encompass project closure, documentation of lessons learned, and closure of contracts. The closing process, which formally acknowledges the project's completion and brings it to an orderly conclusion, is engaged in. This includes testing and commissioning the deliverables before transferring the project to the client for operation.

4.2 Monitoring and control processes

In project management, monitoring and control are essential processes aimed at ensuring that a project progresses effectively and efficiently towards its goals. These processes involve tracking various aspects of the project's performance, identifying any deviations from the plan, and taking corrective actions to keep the project on track.

Monitoring involves regularly observing and measuring the project's progress against the established baselines, including scope, schedule, budget, quality, and risks. This typically involves gathering data through various means such as progress reports, status meetings, and performance metrics. The collected data is then analyzed to assess whether the project is meeting its objectives within the defined parameters. (Burke, 2009, p. 270)

Control, on the other hand, involves acting based on the information gathered during the monitoring process. This may include implementing changes to the project plan, reallocating resources, revising schedules, or addressing any issues or risks that may arise. The goal of control is to keep the project aligned with its objectives and ensure that it stays on course to deliver the desired outcomes. (Burke, 2009, p. 265)

Effective monitoring and control processes are critical for project success as they enable project managers to detect problems early and take timely corrective actions. By staying vigilant and proactive in monitoring and controlling the project, stakeholders can minimize risks, avoid costly delays, and maximize the chances of achieving project objectives within the allocated resources and timeframe.

Furthermore, monitoring and control are not isolated activities but are integrated throughout the project lifecycle. They require continuous attention and adjustment as the project progresses from initiation to planning, execution, and closure. Additionally, clear communication and collaboration among project team members and stakeholders are vital for effective monitoring and control, ensuring that everyone is informed about the project's status and any necessary actions to be taken. (Burke, 2009, p. 59)

Overall, monitoring and control are fundamental project management processes that help ensure projects are delivered successfully, meeting stakeholders' expectations and delivering value to the organization.

4.2.1 Components of project Control

Here are some but not all the key project management process involved in the project control process, these processes will be sources of information to gather a wider perspective of the elements that could affect the project, and need to be taken into consideration in order to achieve the most accurate perspective over the project:

Figure 4-1. The project management process involved with project control.

In project management terminology, 'control' encompasses various key actions which facilitates the acquisition of necessary information for reporting purposes, Chemuturi (2013) suggest the followed ones:

1. Establishing plans in accordance with approved organizational standards.
2. Regularly assessing project progress across schedule, quality, productivity, and cost.
3. Comparing actual progress against planned benchmarks to identify discrepancies.
4. Implementing corrective measures to address any unfavorable deviations.

5. Proactively implementing preventive measures to maintain alignment between actual and planned progress in the future.

This concept of "control" extends to managing the project's success indicators which are generally define encapsulated in:

a) Schedule: Monitoring and managing activities to adhere to planned timelines, ensuring timely project completion.
a) Cost: Striving to keep expenditures within the approved budget, even as certain activities may exceed or fall below budgeted amounts.
b) Quality: Emphasizing adherence to design and material specifications and upholding organizational standards to maintain desired quality levels.
c) Productivity: Continuously evaluating and upholding productivity levels, whether involving in-house resources or subcontractors, by aligning with organizational productivity baselines.

To manage these four project variables, it's essential to conduct multiple measurements, analyze the data, and engage in various activities to maintain oversight of the project. Further elaboration on each of these aspects will be provided in the subsequent sections.

4.2.2 Schedule Control

The project Schedule, according to Horine is the technique that merges all the work task to be performed and their interconnection, the estimated time and resources needed for the project based on the calendar. The project schedules should reflect the work breakdown structure (WBS), resources plan, work estimates, key milestones, responsibility assignments (RASIC), quality management plan, risk management plan, communication management plan, procurement plan, staff management plan.

According to Hulet (2006), the project schedule serves to forecast the completion and milestone dates, while also aiding in the management of daily tasks and resources, and documenting progress (Hulett, 2009). As such, the schedule serves as a backbone for the project, playing a crucial role in project management. Chemuturi warns that delays in the schedule could lead to postponement of planned business operations, resulting not only in project cost overruns but also in foregone revenue from utilizing by the project, for that reason we need to ensure all critical activities are closely monitored and all required resources are provided on time, all critical activities are

completed on time conforming to the schedule, The noncritical activities are completed before their latest completion dates . (Chemuturi, 2013)

4.2.3 Cost Control

Cost control entails overseeing and regulating expenditures within an institution to uphold financial stability and attain profitability. Gowtham suggest that This procedure encompasses recognizing and evaluating diverse cost components, including operational outlays, production expenses, and overheads, and introducing strategies to diminish or streamline them. Cost control holds immense importance for organizations due to several compelling reasons. Firstly, it plays a crucial role in maximizing profitability by efficiently managing expenses, thereby allowing businesses to enhance their earnings and bolster financial performance. Additionally, it fosters financial stability by mitigating the likelihood of crises and cash flow issues.

Moreover, cost control facilitates strategic decision-making by offering valuable insights into cost drivers and expenditure trends. This enables organizations to make well-informed choices regarding resource allocation and investment strategies. In essence, cost control serves as a strategic instrument that harmonizes financial stability, profitability, and growth, empowering organizations to flourish amidst evolving business landscapes. (Gowtham, 2024)

Cost control stands as a critical managerial function, yet it frequently gets conflated with mere cost reporting. While the cost report typically forms part of every manager's monthly update to superiors, it primarily recounts past month's expenditures, offering a retrospective view. What managers truly require is a consistent and current monitoring system that empowers them to pinpoint expenses related to specific operations or phases, assess whether these expenses were cost-effective, analyze trends, and promptly intervene if any trends prove unacceptable. (Lester, 2017)

Chemuturi explains the process of cost control start from seeking project approval, it's essential to estimate the expenses anticipated for project execution. Once approved, this estimation becomes the project budget. As project execution commences, funds from this budget are utilized to cover project expenses. As highlighted earlier, it's crucial to closely monitor costs to ensure the project is completed within the approved budget.

4.2.4 Quality Control

Quality control is the process companies go through to confirm the project has achieved the require quality or condition. although quality assurance strives to ensure that the company has the capability of making the project right first time, quality control is the company last line of defense to prevent substandard deliverables being given to the project sponsor or program manager.

Quality control encompasses a variety of methods including inspection, testing, and measurement. These methods are utilized to verify that the deliverables adhere to specified standards, ensuring they are suitable for their intended purpose and align with the requirements of clients and stakeholders. A quality control plan establishes a connection between quality requirements, construction methods, execution strategies, and the project schedule represented by a Gantt chart. It provides the project manager with the ability to enforce the predetermined work sequence necessary for quality, rather than prioritizing what may be deemed resource-efficient by the production department. This can be achieved through a quality control plan that outlines the sequence of work and the extent of inspection and testing required. The sequence of work is determined by the construction method and the network diagram, while the level of inspection is influenced by the associated risks and the necessary degree of control. (Burke, 2009)

4.2.5 Productivity Control

Productivity has multiple definitions however in the project context summarize pretty much in the amount of effort measured in Person- hours for accomplish a task or work unit based on the level of experience and the supervision required needed. This will be translated in cost for the project, a poor productivity means an increase in project effort and related cost and scheduling slippages.

Given that we can inspire individuals to perform at levels surpassing the average or at least meeting average expectations, it's imperative to monitor project productivity and take prompt corrective measures. A common corrective action necessary in projects involves motivating employees whose productivity falls below organizational standards. However, the significant challenge arises when financial rewards cannot be promised, nor can job stability be threatened. Often, project managers may be unable to provide immediate financial incentives, especially to underperforming employees. Moreover, terminating such employees during an ongoing project could lead to

additional delays due to the time lost in replacing resources and training new personnel to reach operational efficiency. (Chemuturi, 2013)

Effective techniques for motivating underperforming employees are recommended for Chemuturi, he recommends counselling the individuals on the necessity to perform better making comparison of their performance over similar employees as a technique of motivation aim to search the self-interest in perform better, as well recommends coaching the individual who may require some extra training, he recommends the use of senior employees will aid to the cause. Sometimes just the verbal ratification of their capabilities will create enough encouragement to do better, however, the appraise of individual being honest in the case of deteriorating performance will give a truthful vision and lead to a reinforcement of the previous suggestion.

4.3 Tools and techniques used in Monitor and control processes.

Monitoring and control in project management involves a variety of tools and techniques to track projects progress, manage resources and ensure that the projects stay in track. in the context of PM, “tools” and “techniques” are often used together, but they refer to different aspects of managing a project.

Tools in one side are tangible items or software applications that assist in performing specific tasks or functions related to PM, this provides functionalities such as scheduling, task tracking, communication, collaboration, risk management, quality management, resource management, cost control and reporting between others; aiding project managers and team members in planning, executing, monitoring and control various aspects of the project.

Nowadays in the market available a large variety of software’s applications as JIRA, Trello, Spreadsheets, and a lot more new ones entering the market, as well as others more known as Microsoft Project, Primavera P6 Oracle; even we are seeing the inclusion or integration of tools like “Teams” that allows the interconnection of multiple tools in one space being able to customize to cover the necessities of the project, giving the option to integrate all the team members keeping them aligned in the status of projects in real time, making more efficiently the allocation of resources, activities and responsibilities.

Microsoft Office package is as well one, if is not the most used tool in project management, where in each sub-tools like Word, Excel, PowerPoint, Visio, between others, team members as been developing for decades the techniques for planning, developing, monitoring and control the projects.

Techniques in other hand refers to the methods, processes, procedures, or approaches used to accomplish specific objectives or task of the projects, this provides frameworks and methodologies for addressing common challenges, managing risk, optimizing resources, following cost between many others aiming to project success.

Techniques often involve a set of best practices or guidelines that have been developed and refine over time to improve projects outcomes; based on the activity referred you could use a variety of techniques. For this study, we going to enlist some of the techniques used in during the implementation of components of projects control:

- Risk management:
    - Montecarlo simulation.
    - Risk heat map.
    - SWOT analysis (strengths, weaknesses, opportunities, and threats).
    - Bowtie analysis.
    - Key risk indicator.
    - Failure mode and effect analysis (FMEA).
    - Risk Matrix.
    - Decision tree.

- Quality Management:
    - Failure mode analysis (cause and effect analysis).
    - Pareto analysis.
    - Trend analysis.
    - Check sheets.
    - Histograms.
    - Scatter diagram.
    - Stratification.
    - Run Charts and control charts.

- Change control management:
    - Change of contract scope format.
    - Change management register.

- Issue management:
    - Issue log.

- Procurement management:
    - Approved tender list.
    - Budget:

        - Activity-base budgeting.
        - Incremental Budgeting.
        - Valure proposition budgeting.
        - Flexible budgeting.

- Requirement management:
    - Product requirements documents (PRD).
    - High Level Plan (HLP).

- Performance reporting:
    - Schedule:
        - Critical path method (CPM).
        - Program evaluation and review technique (PERT)
        - Fast tracking.
        - Crashing.
        - Gantt chart.
        - Simulation.
        - Task List.
        - Resource Leveling.
    - Cost Control:
        - System man-hours and cost (SMAC).
        - Earned Value Analysis (EVA).
        - Cost-benefit analysis.
        - Cost reduction.
        - Cost accounting.
        - Activity-base costing.
        - Budgetary Control.
        - Target costing.
        - life cycle costing.
    - Cash flow:
        - S-curve Histograms.

The previous enlisted techniques do not pretend to limit the existence of other techniques but illustrate some of the most used in the project management field, each technique will be selected to the individual necessity of a company in alignment with their own methodologies accommodating to their best results.

5 Project reporting

This segment investigates into the established understanding and optimal approaches within the dominion of project reporting. An integral component of project management and a fundamental requirement for effective communication within projects is project reporting. This is one of the mechanisms implemented to gather and distribute project related data, this can be gathered, processed, and reported in many way and different format structures.

In project management not all the reports are directed to the same audience, many reports are built from other reports that subsequently are built from others reports and more over until the come from the original source of information. Usually reports maturate from source up to the portfolio project management or even steering groups. Each of these reports clean and refine the information to fulfill the specific requirements of the audience summarizing and guiding clear and assertive information.

Employing a systematic approach to project reporting processes and practices enables the dissemination of current and punctual information to stakeholders. However, merely presenting information in a manner that aligns with stakeholder preferences represents just one facet of reporting. Equally important is the gathering of information from various sources, refining it, and analyzing it to meet desired objectives.

Reports should be specifically crafted to aid in problem-solving and decision-making across different levels of management. This approach enables the project manager to guarantee that the project stays aligned with its stated goals and objectives. Without adequate reporting mechanisms in place, monitoring a project becomes challenging, and without appropriate monitoring, the project's risk level may escalate.

Reporting in project management is based in the data gathered in monitoring and controlling processes, as presented in the previous section we can see the multiple variables that a project need to monitor and control, but as well how we can embark the main data in project success indicators as schedule, cost, quality and productivity, however, nowadays we can not lave in a side the monitor and control of risk management from an overall presentation of project report.

5.1 Frequency of reports

During the lifecycle of a project we going to see different types of repots, which ones going to present different information, some of the report types are the “Status report” which present the actual state of the project or specific areas of it to-date-of presentation; “Forecast reports” that will give a prediction do date of presentation of how the project will be in certain time based on the analysis of existing data and applying techniques to predict where it going to be in X time. Financial reports” enclosure the money related status of the project or project portfolios.

The most common report in projects is the “Progress report” explains where the project was, where is it now and where is expected to be in the followed days, using different techniques to present the information, this type of report tends to convert all the aspects of the project in a very concise but effective and explicit way. Project progress should normally be reported once every week, and generally these reports should be aligned with the schedule of weekly project team meetings. Burke (2009) suggest to structure as much as possible, in this way if the managers are asked to report against a structured format, they will generally answer it honestly. These reports are assembled by project team members or project managers but presented to project managers.

Depending on the size and structure of some companies, some reports will be destinated every month to the project portfolio management team, these reports contain information of 2 two or more projects according to Roberts (2007), the portfolio management teams bear the ultimate responsibility for the portfolio status. Consequently, the team must convene regularly to assess the portfolio’s health and performance, in this type of report is not seeing the detail of each project presented instead and overall status of all projects in conjunction, these reports are presented to senior/ lead managers by project managers.

Other type of report that tends to be presented every month is the “steering committee report”, this in contrast to the project portfolio report is presented to stakeholders, which could include customers, contractors or even departments in the organization that will be the most affected by the project, people in the steering committee aren’t always working on the project, they tend to be mor C-level executives. This report is presented by senior managers or lead managers.

5.2 Time spent in report execution.

Project managers face daily a wide range of activities to execute and maintain the integrity and efficacy of projects, the development of activities related to projects and the registration of this activities in the many deliverables require to assure a proper quality product/ project, are no doubt, one of the mains time consumers during the working time, added to this the time spent in meetings related, create a very tight schedule to realize the compilation, analysis and creation of reports and its presentations.

The report writing includes the compilation of many data sources but as well the creation of trends and graphics that tend to be a real headache in time consumption if the formats are not standardize and tools are not align.

The time spend on project reporting could be determined by:

- The stage of the project lifecycle at the moment, meaning less reporting during start up and increased reporting during execution.
- Project stakeholders' expectations.
- Reporting standards/ requirements in the organization.
- Reporting tools used (MS Project/ Jira/ Excel etc.)

Though, this time could be shortened applying standardized tools and techniques among project monitor and control processes, as well as creating automation from the formats used, bringing information in actual time from original sources to the report formats.

Nowadays, many projects use tools that interconnect teams and allow then to work online on same documents in the Microsoft office tools in actual time, using the storage of documentation in clouds allows to access to the data even easier and efficiently among teams, however the automation of reporting formats still not well documented or popularized amor project teams.

5.3 Automation in Microsoft office tools

Microsoft Tools has been the most used among project teams along decades, is difficult to try to visualize a document not made in MS Word or tabulations and trends not developed in MS Excel, even that nowadays exist a vast range of applications that fulfill these necessities, Microsoft tools still the most accessible worldwide.

Between the millions of features able to achieve with Microsoft, application integration is one of them, this feature allows to integrate information from one office application into another application, not only by copy and paste data in the basic way but in a more dynamic way.

Microsoft has enhanced and refine its capability to share files via cloud services and facilitate real-time collaboration. the seamless integration across Microsoft office applications, enabling effortless information sharing between them, is a valuable feature often overlooked. The ability to compile data from various applications into reports or presentation without the need for data conversion is truly invaluable. much of this data sharing is called “Object Linking and Embedding”, as well Known as OLE, and has been Accessible since the 90’s. In “OLE” the “Object” encompasses any selectable entity within any of the office applications.

In Linking, an “object” created in one application can be referenced and displayed within another application. If the original object is updated, the changes are reflected in all instances of that object across different documents or applications. However, the data remains stored in the original application.

Embedding allows to insert an object from one application directly into another application. This means that the object becomes part of the document itself, and it can be edited using the tools of the hosting application. Changes made to an embedded object do not affect the original source.

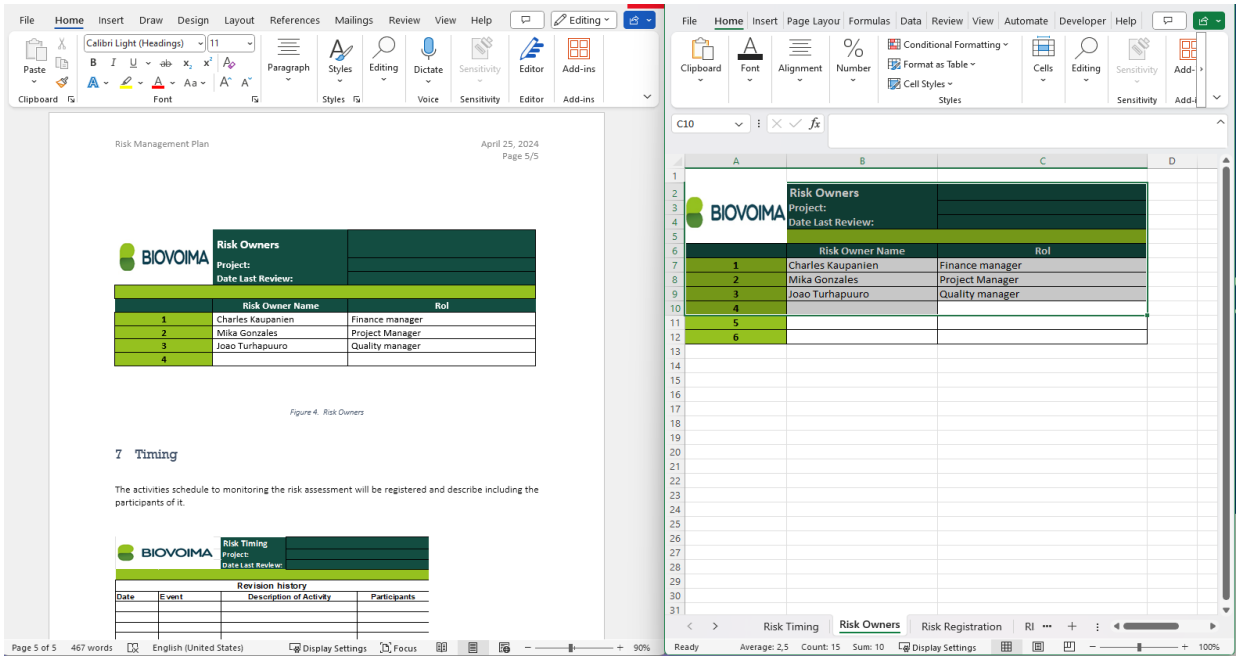


Figure 5-1. Linked Information in a Word document from and excel source data.

For the purpose of this thesis, the selection of linking objects over embedding objects was made due to the dynamic nature of the data related to reports. Linking objects can be effectuated in different approaches as Linking with Paste Special, other possibility is the Paste Options Gallery and a third possibility is creating a Link to a external data using object command on the ribbons' insert tab. (Habraken, 2022)

To create a link using "Paste Special" in Microsoft Office applications such as Word, Excel, or PowerPoint, follow these steps:

1. Copy Content: Select the content you want to copy. This could be text, numbers, formulas, charts, or any other element you wish to link to.

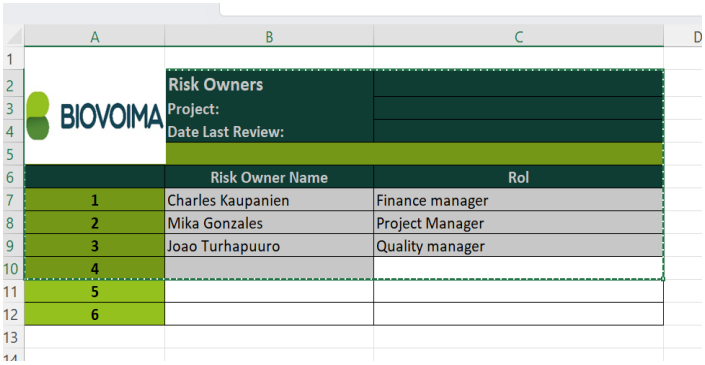


Figure 5-2. selection of data from Excel sheet.

2. Copy the Content: Right-click on the selected content and choose "Copy" from the context menu. Alternatively, you can use the keyboard shortcut Ctrl + C (Cmd + C on Mac) to copy the content.

3. Navigate to Destination: Go to the location where you want to paste the linked content. Click on the cell, text box, or area where you want the linked content to appear.

4. Open Paste Special: Now, instead of directly pasting the content, you'll use "Paste Special" to create a link. Depending on your version of Microsoft Office and the application you're using, you can usually access "Paste Special" from the following options:

    - In Excel: Click on the "Home" tab in the ribbon, then click on the small arrow under the "Paste" button. From the dropdown menu, select "Paste Special."

- In Word or PowerPoint: Right-click on the location where you want to paste the content and choose "Paste Special" from the context menu.

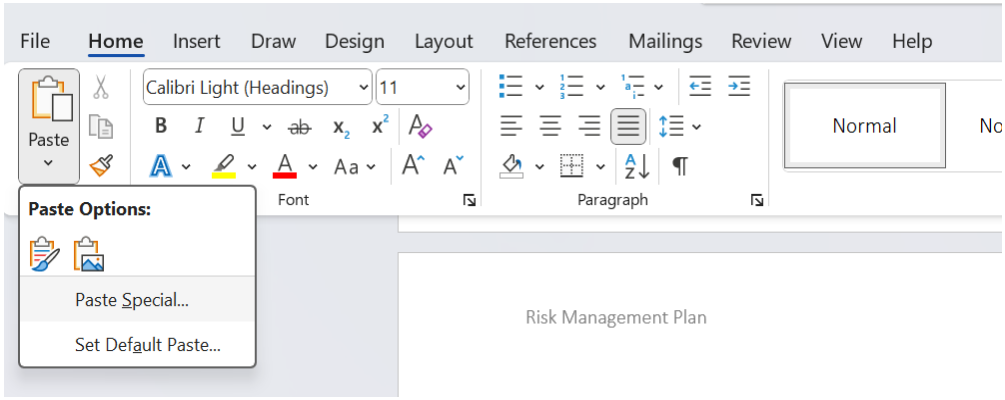


Figure 5-3. Selection in destination of Paste special.

5. Select Paste Link Option: In the "Paste Special" dialog box, you'll see various options for pasting the content. Look for an option that includes "Link" or "Paste Link" in its name. It might be labeled as "Paste Link," "Paste Link Excel Object," or similar, depending on the type of content you're pasting.

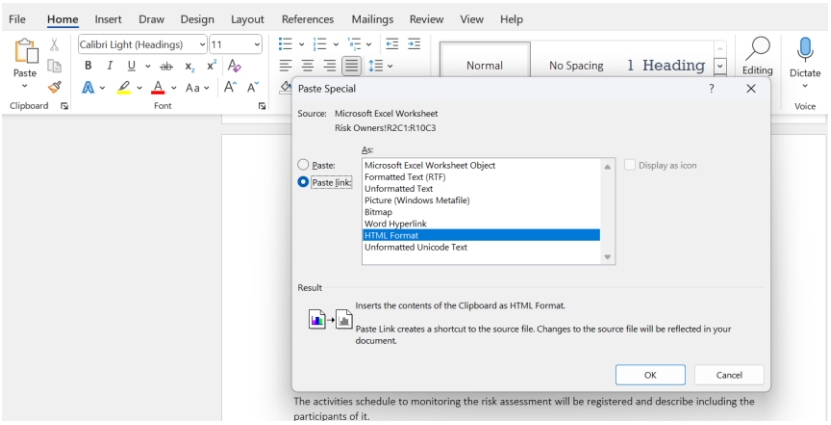


Figure 5-4. Linking display.

6. Confirm and Paste: Once you've selected the appropriate "Paste Link" option, click on it to select it, and then click "OK" or "Paste" to paste the linked content into your document.

7. Review and Update Links (if necessary): If you're working in Excel and have linked cells, formulas, or charts, you may need to review and update the links if the source data changes. To do this, go to the "Data" tab, click on "Edit Links," and manage the links as needed.

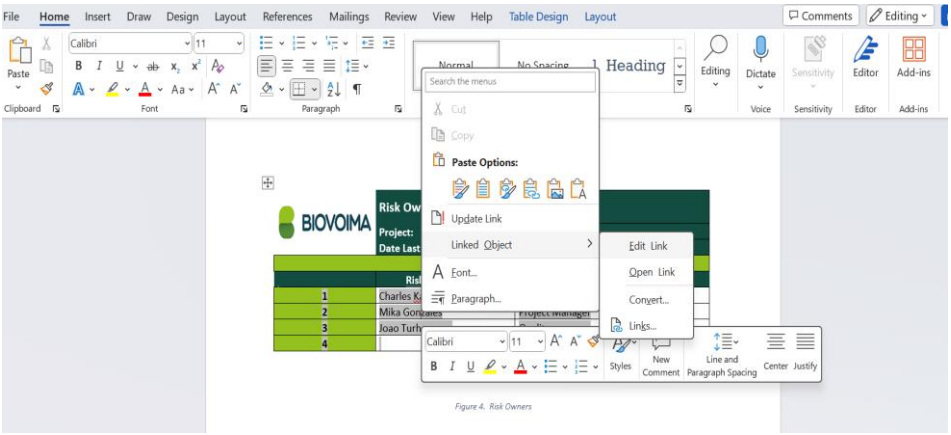


Figure 5-5. Screen of selection on data for modifying the source.

In case you want to change the location of the files, you will have to actualize the links otherwise the actualization of data will not be made. Every time you open the file with the destination link and the information has been actualize, it will appear a box notification giving the option to actualize or not.

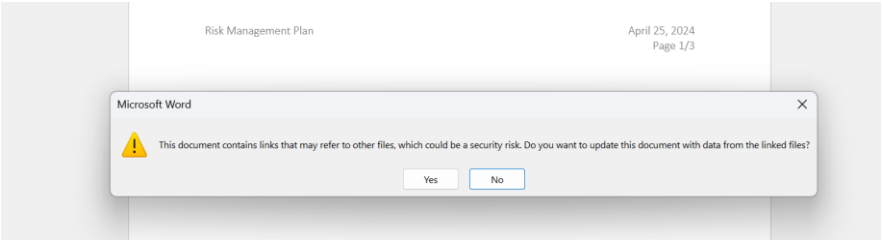


Figure 5-6. Notification of actualization of data.

If in some moment you need to modify the location of the files or break the links, click on “File”, then “Info”, and go to “Edit links to files”.

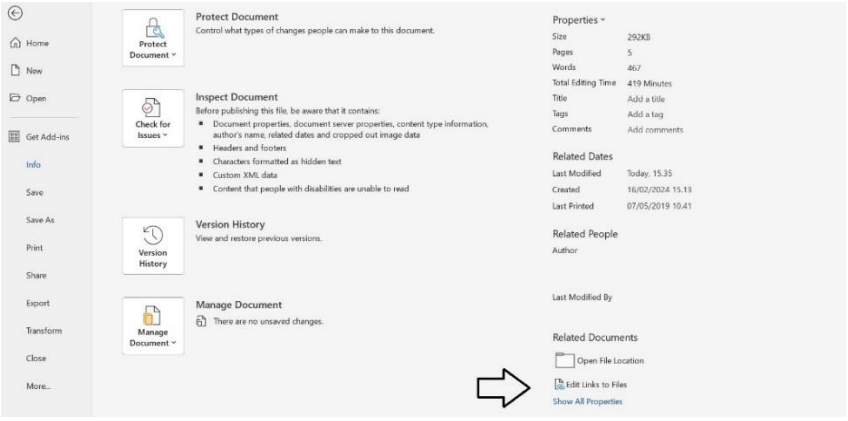


Figure 5-7. Break or modify the link step 1

In this window it can break, modify, actualize, or customize the link to preference.

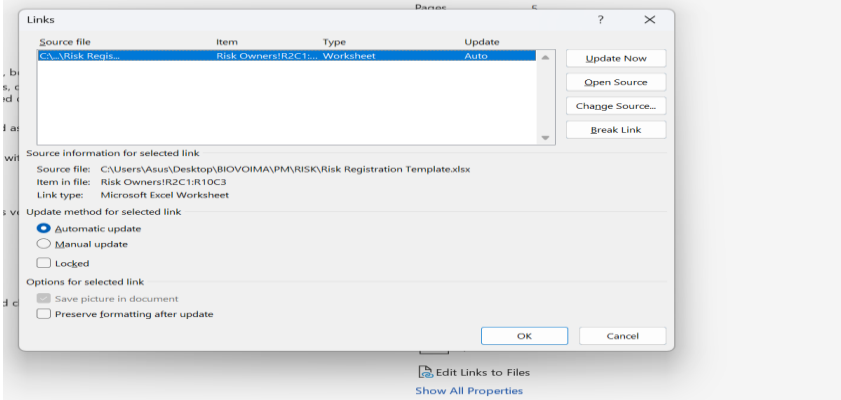


Figure 5-8 Break or modify the link step 2.

By following these steps, you can create a link using "Paste Special" in Microsoft Office applications, allowing you to dynamically update linked content when the source data changes.

6 Implementation

This section discusses the results of the current state analysis of the project management processes on the findings from the observation or working environment, the analysis of the company documentation and its internal systems, as well as the semi- structured interviews to the project management team and other personnel involved in the project management processes.

Implementation will be divided in three sections; the first section will be covering the project management process topic, where it is an analysis of the current process state, how is registered in the company systems, with a description of it, then it will be presented the implementation the new project management process and the implementation of the agile and lean methodologies over the process.

Figure 6-1. Implementation project management process.

The second section is going to aboard the selection of tools and techniques used in project management processes, specifically in the monitoring and control process of the company, on this section is presented the findings from company data from the current and previous projects and the sustentation of selection of tools and techniques to be improve, finally it will be presented the tools and techniques optimized.

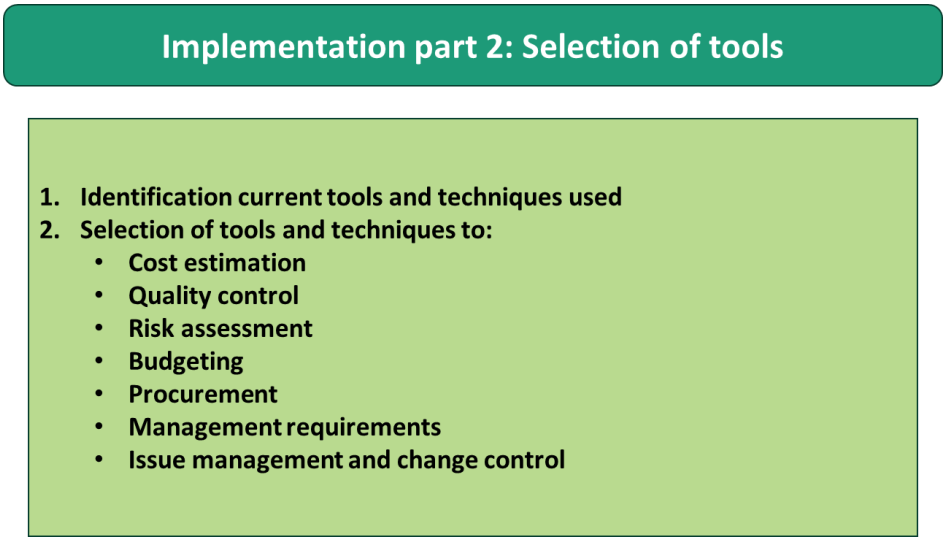


Figure 6-2. Implementation selection of toos and techniques

In the third and final section of the implementation, it is presented the current formats used in the different reports and the optimization and automation of them as a final implementation.

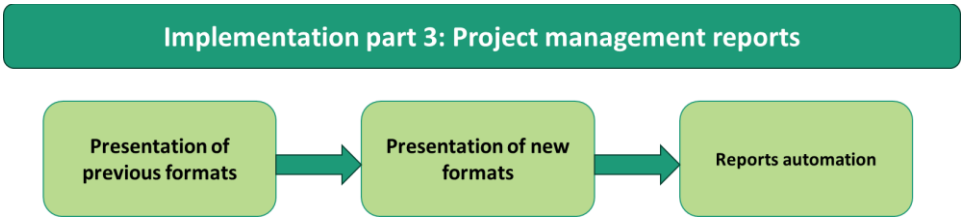


Figure 6-3. Implementation reports automation

6.1 Section 1: Project management process

6.1.1 Overview project management process

Company has been evolving since its foundation from a sales vision, passing to developing their own technologies and then integrating it with the available technologies in the market. more recently entering the market of EPC projects; opening the portfolio of technology option for customers, being able to select from a single product or even customize a package of technological products to their necessities.

For the project management department this mean that projects could be from and specific work order (WO) to a full delivery process; giving a range of variables to the possible scopes; meaning that the level of complexity is also variable but not attached to the size or price of the project.

If is truth that straight work orders from one product could mean just a delivery, also this could be from an own company development product or a customize product that most likely will require engineering design, will need time to maturate, manufacture and deliver; making use of more resources from projects management department than just a delivery control.

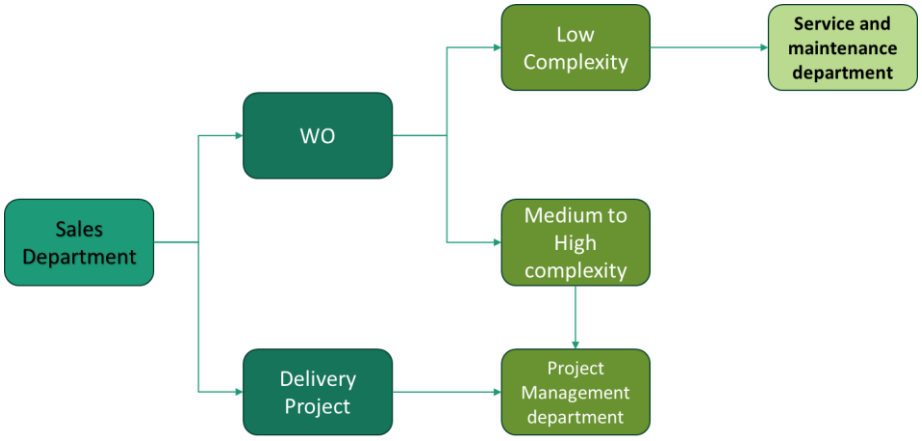


Figure 6-4. Project complexity chartflow

After sales department has closed a contract of working order process, it will be defined with the support of project management department if the contract requirements classify the work order as a low complexity or medium to high complexity, in case of being low complexity, this order will be transferred to “service and maintenance department”, otherwise goes to project management department for its execution.

Currently the project management process has not clear procedure, or chart flow inside the company data base, the only proximity registered is found in the document “Biovoima_prosessikuvaus.xlsx”; the document is presented in the Annex A “Biovoima Oyprocess description”; an extract of it is presented in the followed image:

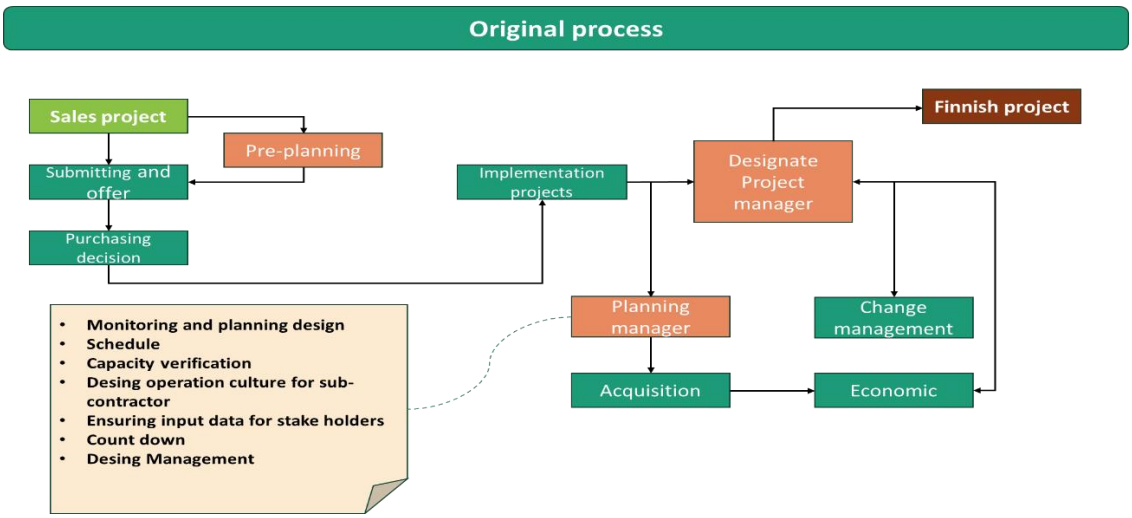


Figure 6-5 Original Process path

In the process we can see has a first activity the “sales project”, here the department of sales work in the client’s portfolio and tendering activities, here depending on the magnitude of the project, a support from project management department will be provided aiming to develop a pre-planning over the possible project. In the positive situation of a “purchase decision” once the WO or project delivery as signed off the contract, it starts the “implementation of the project”, where purchasing department starts an actualization of the price market over the budget; and the assignation of the project management is made by the project management leader in conjunction with the management board.

Once the project management has been assigned, the planning manager start the monitoring of the process design, and the development and actualization of the project schedule, the project team start the verification of the technologies capacity, in case the company use a sub-contractor to support the design process, this will be supervise by the design and engineering manager; finally the project manager will ensure the production of the input for the stakeholders.

the activity of change management its an isolated action, only use in case of being required and do not make part of the cyclical process during the implementation. The evaluation of economics and acquisition of the procurement are activities that will be constant and reviewed in order to proceed. as last once it’s fulfilled the implementation it marks the finalization of the projects.

6.1.2 Developing a new process

The new project management process was developed based in the theorical research included in this study, the research based in the semi-structured interviews and the informal meetings made with the projects management team.

For this process we apply the bases from the project lifecycle mentioned by (Burke, 2009)and (Lester, 2017), making and adaptation to the company necessities. The process has a project lifecycle of 4 phases, the handover, maturation, execution, and closure.

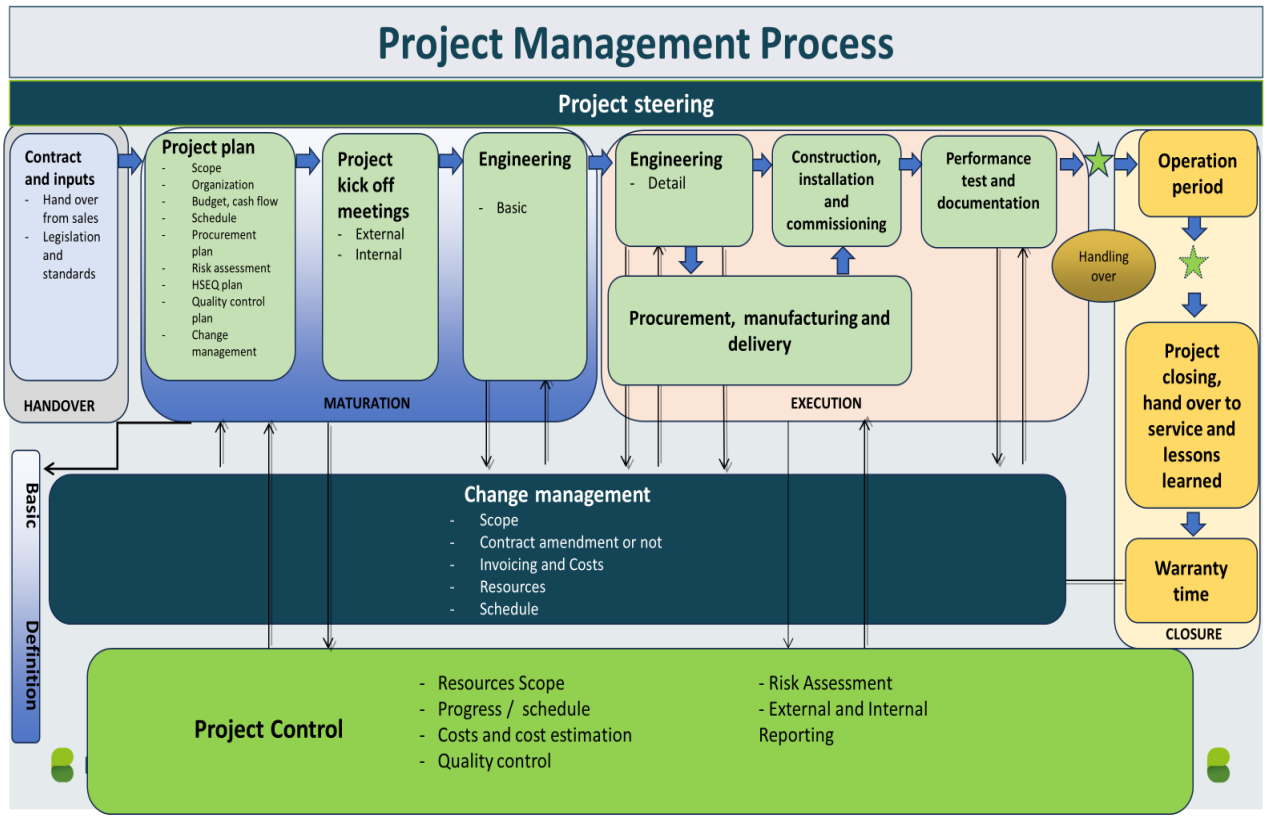


Figure 6-6. New project management process

Handover will encapsule the transition from sales department to project management department, where the last one will do a review with the feasibility check list to initiate the familiarization with the project, giving in this way a larger vision of the scope of the project, and facilitating in this way the classification of the project as small, medium, or large project. Sales department will be the responsible to facilitate the documentation related from customer as it is contracts and initial inputs.

Maturation phase begins with the development of the project plan, this plan delimited the scope, work breakdown structures (WBS), schedule, budget, procurement plan, risk plan, HSEQ plan, quality control plan, change management procedure, and organization. Once the project plan has been defined, the kickoff meeting will be executed with the internal and external parts, starting at same time the maturation of basic engineering.

During the maturation process presented in the Figure 6-6. New project management process, we can see the gradient colors in the maturation box, that are referred as “Basic” and “Definition”;

this gives a subdivision to the maturation process in two stages, these stages are describe as basic maturation and detail maturation. in the Appendix 2 “HIGH LEVEL PLAN (HLP).xlsx” we can visualize the different activities and the correspondent deliveries for each stage into more detail.

In the process presented in the Figure 6-6. New project management process, we can visualize the detail engineering as a part of the execution phase, but in reality, it may start in maturation phase and extends until the execution phase.

During the execution phase by the hand of the continuation of the detail engineering, procurement department will generate the purchasing orders based on the specification details on the engineering for the different equipment’s require, initiating on that way the manufacturing and delivery process heading to the construction and installations; once is ready the commissioning activities will be prompt. Finally, performance test and documentation will be culminated, opening path to the transition of the “handling over” to customer.

Closure phase initiate with the operational period, this will be stipulated based on the contract conditions, once is fulfilled satisfactorily, the project management will be taking order of pending documentation, checking with finances department that all responsibilities are handled, during this closure phase one final workshop will be held to made the registration of the lessons learned, marking this activity has the last action overall; leaving just over the time the Warranty time as a possible activity.

The activity of “change management” has been represented from the handover from sales until the execution stage with the intention of leave open timeline to any possible require change by the project or the customer, it could happen in any moment between those stages, but will not be an option after the culmination of the execution. The project control activities in other case are being represented as a constant from the initiation of the project until the closure of it, is define as a continue activity.

6.1.3 Implementation of lean and agile methodologies over the project management process

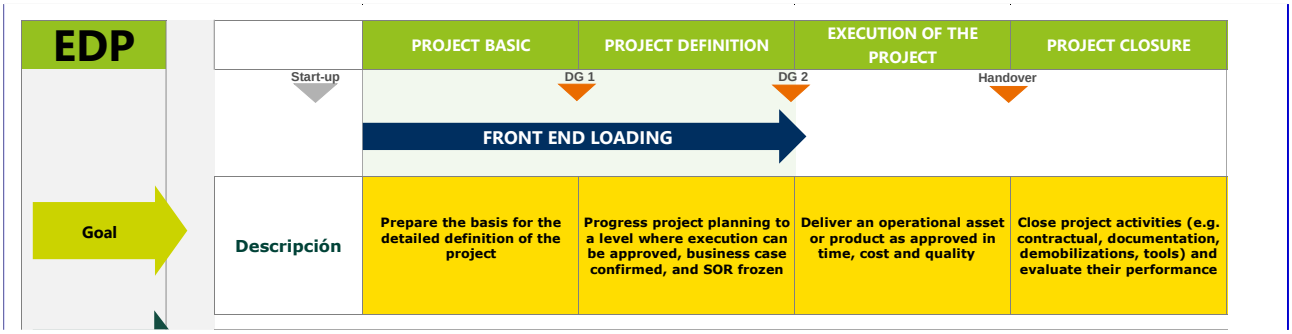


Figure 6-7. Process flow in HLP

- Focus value: Stream mapping will be used in the project management plan with the cooperation of procurement.

- Sprint reviews: Are held by the end of the project basic stage, the definition stage and finally at the end of execution stage to analyze how was the project overall. This will be held by project management leader, project team and management board of the company with the intention of serve the result and evaluate improvements for future projects.

- Iterative development: The agile iterative approach has been implemented in the project management process, and being detail into works more manageable along the maturation process, this is reflected in the Appendices (1,2 and 3) “HIGH LEVEL PLAN (HLP)” were the maturation as being divided into two stages. In the appendices we can visualize for example the “WBS”, where in the basic stage is only required a detail level 2, and for the definition stage is require a detail level 3-4, meaning that the work package will be more detail and structured, implementing kaizen a long these maturations will help to identify improvements along the project’s activities.

- Waste elimination: Is implemented with retrospectives over waste, and is reflected a long project lifecycle, especially in the registration of lessons learned, which are effectuated in each stage and registered as an activity in the Appendices (1,2 and 3) “HIGH LEVEL PLAN (HLP)”.

- Visual management: For the purpose of this study is recommended to the lead of project management department, the implementation of “agile task board” as a tool to improve the visual management of the portfolio due to the fact of being an application available in the platform “Team”, which the company and the project management department are using in daily basis.

- Continuous improvement: Applying “PDCA + Inspect and adapt.” is part of the main values of the company and has been enforced with the implementation of the quality management systems, but as well as a philosophy for the project management process, especially in the monitoring and control processes, which will be referred deeper in the section 2 of this chapter.

- Empowered teams: is promoted with the implementation of the High-Level Plan, giving clear activity list, illustrating in this way the activities that could be derivate to other departments for support as is shown in the Appendices (1,2 and 3) “HIGH LEVEL PLAN (HLP)”.

- Customer focus: Is granted in the activities developed by the project management leader and in the organization teams, always leading to a high customer engagement in every stage of the projects.

6.2 Section 2: Selection of tools and techniques

6.2.1 Identification current tools and techniques used

During the research for this thesis, access to documentation from three past and present projects was granted by Biovoima Oy The documentation was accessed through Microsoft Teams, where each project has its own dedicated "team" space, with data stored in connection to SharePoint. It's important to clarify that each of these projects has had different project managers in charge at various times.

In general, the projects use Microsoft tools as Word, Excel, PowerPoint, and in the process of gathering financial data is used Talenom as tool, however, currently the company is starting the migration of data to a new ERP system.

Basing the selection of tools and techniques solely on monitoring and controlling projects, the identification and review process will exclusively focus on activities related to these processes.

- **Quality Management:**

  It seems that the company or project management department has not yet developed a formal process or established specific tools or techniques. Currently, the company is in the process of developing a quality management system based on ISO 9001:2015 certification. However, at the time of this research, the certification has not been implemented or approved. As a result, the study refrains from implementing any techniques to avoid interfering with the activities related to the development of the quality management system.

- **Issue Management:**

  It seems that the company or project management department has not yet developed a formal process or established any specific tools or techniques for issue management activities. This indicates a potential area for improvement or development within the project management framework. Issue management is crucial for identifying, addressing, and resolving problems that arise during project execution, so establishing a structured approach could enhance project efficiency and outcomes.

- **Requirements Management**

  It appears that, at present, the company or project management department has not formalized any process or adopted specific tools or techniques for basic project management activities. Apart from the Original Process path outlined in Figure 6-5, all activities have been driven by project instinct. Documentation and activities related to projects have been tailored to the individual requirements of customers during the tender phase. This insight was expressed by project managers and company members involved in project management activities during interviews conducted as part of this research.

Indeed, in Biovoima Oy, as in many project management contexts, the fundamental activities and requirements revolve around monitoring and control. This encompasses various aspects such as scheduling, budgeting, cash flow management, risk management, procurement activities, and project planning. These elements are crucial for ensuring that projects stay on track, resources are utilized effectively, risks are managed, and objectives are achieved within the specified constraints. Monitoring and control serve as the backbone of successful project management by providing oversight and ensuring alignment with project goals.

- **Change Control Management**

Currently, the Project Management department has been implementing a change control process during project execution. This process utilizes MS Excel as a tool, with the primary objective being to register any potential changes requested by customers or any department involved in the projects that could alter the project scope.

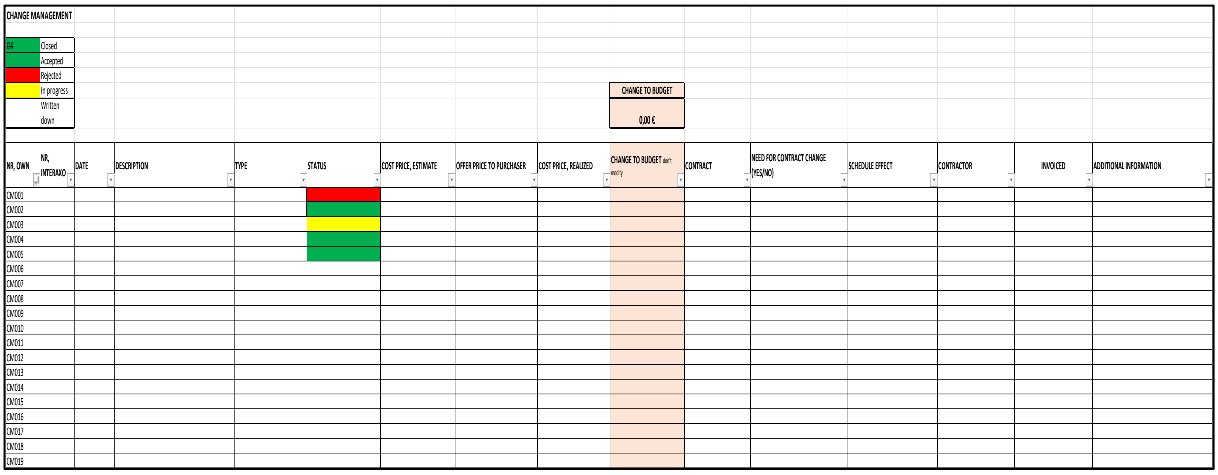


Figure 6-8 Change management original

The format depicted in Figure 6-8, "Change Management Original," provides the option to register a range of actions such as "Closed," "Accepted," "Rejected," and "In Progress." This allows for the visualization of all considerations throughout the projects, enabling the identification of change necessities and types, such as changes in works, additional costs incurred by the company, and extra work due to additional activities purchased by customers. All changes are directly related to the budget. The implementation of this format has been carried out across the three projects used in this study.

- **Risk Management:**

The project management department has utilized two models of risk registration thus far. It was noted in the research that Project 1 did not execute the activity throughout the project. Project 2 and 3 used different formats inherited from the customer side. In Project 2, the technique of Risk Priority Number (RPN) was employed, as illustrated in Figure 6-9, "Risk Register Project 2." This format includes identification of Severity (S) and Probability (P), also referred to as Occurrence (O). However, the calculation only considers two values, while the basic theory of RPN emphasizes a calculation based on three variables: Severity * Occurrence * Detection (S * O * D). The second sheet of the calculation book provides a reference example for severity numbers but does not offer any further instructions or variables to accurately measure the level of risk.

Project	*Keskonnateenused*
Next gate	*G1 - Contract review*
Today	17/05/2024

The purpose of this is to help the project team share risk knowledge that the entire project may benefit by:
- Minimizing the occurrence of undesirable risks
- Maximizing the occurrence of desirable opportunities

Critical risks with high value in regards to RPN to be controlled by Steering group

Severity = **The expected seriousness of the damage to the Project and Business**
Propability = **The expected likelihood that the risk can occur**

									Addressed in Risk Management Meetings					
ID	Process area	Risk source	What have been noticed? / What is the concern	Impact	Response type	Response plan	Status	Date added	Date modified	Risk owner	Latest comment	Severity	Propability	RPN
1	Technology Solutions & Plant performance	3.6 Client/Customer			Mitigate		Work in Progress					6	5	30
2	Technology Solutions & Plant performance	4.2 Market or Environment			Mitigate		Closed					1	1	1
3	Technology Solutions & Plant performance	1.4 Technical processes			Mitigate		Closed					1	1	1
4	Technical specification and documentation	1.2 Requirement definition			Mitigate		Work in Progress					7	3	21
5	Technical specification and documentation	3.6 Client/Customer			Mitigate		Work in Progress					8	4	32
6	Technical specification and documentation	1.1 Scope definition			Mitigate		Work in Progress					7	2	14
7	Technical specification and documentation	1.1 Scope definition										3	3	9

Figure 6-9 Risk Register project 2

Example / Reference information when ranking Severity

Categories	Critical (10-8)	Serious (7-6)	Normal (5-3)	Low (2-1)
Profitability / IRR / Business performance	•Cost of the risk for the entire project or product will be considerable (>1 M€) •OPEX will be considerably higher (>100k €) •Delivery to the customer will be considerably longer (>6 months) •Business financial losses (>50k €)	•Cost of the risk for the entire project or product will be considerable (>500k €) •OPEX will be higher (>50k €) •Delivery to the customer will be longer (>3 months) •Business financial losses (>20k €)	•Cost of the risk for the entire project or product will be higher (>100k €) •OPEX will be higher (>10k €) •Delivery to the customer will be longer (>1 months) •Business financial losses (>5k €)	•Cost of the risk for the entire project or product will be higher (>10k €) •OPEX will be higher (>5k €) •Delivery to the customer will be longer (<1 months) •Business financial losses (>1k €)
Quality	•Influences severely to the human safety and the environment •Causes direct contradiction to legal regulations or directives •Substantial negative deviations from the needed technical performance	•Influences negatively to the environment •Do not meet with legal regulations or directives in all planned sales destinations •Negative deviations from the needed technical performance	•Risk of "standard" non-conformances at supplier	•Deviations to non-technical features
Organizational and delivery capability	•Non-existant resources and capability in the organization •Major capability challenges at the collaboration network •Major hindering effect to overall progress •Logistics will face tremendous / impossible difficulties	•Lack of needed resources and capability in the organization •Capability challenges at the collaboration network •Hindering effect to overall progress •Logistics will face serious difficulties	•Small influence to optimal procurement and delivery capability	•Negligible influence to procurement and delivery capability
Customer satisfaction	•Critical deviations in the product functionality compared to what is intended •Critical letdowns of customer expectations •Critical difficulties in Aftersales	•Deviations in the product functionality compared to what is intended •Letdown of customer expectation •Difficulties in Aftersales	•Minor effect to overall customer satisfaction	•No effect to customer satisfaction

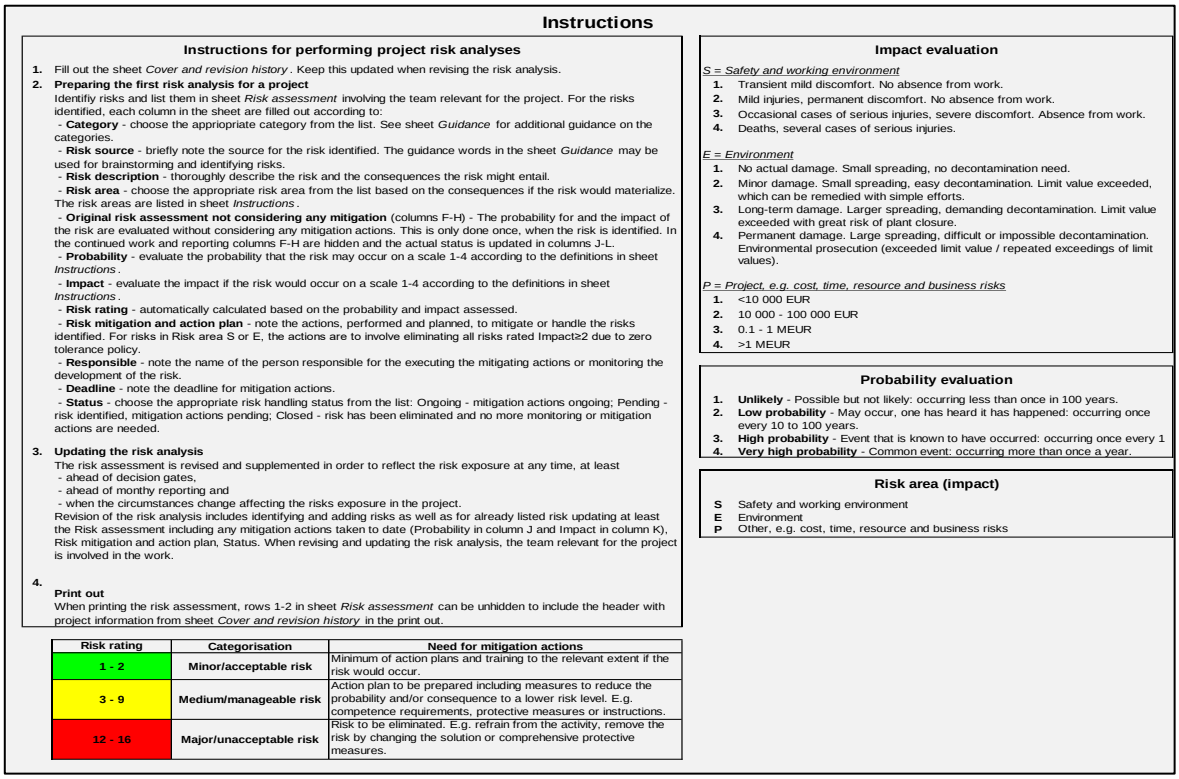
Figure 6-10 Rankin severity project 2

In the data discovered for Project 3, a more comprehensive format emerged, featuring a complete risk analysis based on Probability*Impact, resulting in a risk rating ranging from 1 to 16. This format includes risk mitigation strategies and action plans aimed at reducing the risk to a "residual risk" level. Instructions on how to use the format are provided in the book, as depicted in Figure 6-12, "Risk Instructions Project 3." Key risk indicators (KRIs) are suggested in the guidance sheet of the main document.

Project: | Project no: | Date issued:
Plan/ Site: | Org.: Project management | Project manager: | Version: [1.1]

No	Category	Risk source	Risk description	Risk area	Original risk assessment not considering any mitigation			Risk mitigation and action plan	Residual risk including mitigation actions taken			Responsible	Deadline	Status
					Proba-bility	Impact	Risk rating		Proba-bility	Impact	Risk rating			
19	1.4 Technical - Performance and availability			P	4	3	12		2	4	8			
6	1.3 Technical - Complexity and interfaces			P	4	3	12		3	3	9			
10	2.1 External - Suppliers			P	4	3	12		4	3	12			
24	2.4 External - Customer			P	3	4	12		2	4	8			
27	4.2 Project management - Planning			P	4	3	12		3	3	9			
3	4.3 Project management - Control			P	4	3	12		3	3	9			
7	3.3 Organizational - Financing			P	3	4	12		3	4	12			

Figure 6-11 Risk register Project 3



Instructions

Instructions for performing project risk analyses

1. Fill out the sheet *Cover and revision history* . Keep this updated when revising the risk analysis.
2. **Preparing the first risk analysis for a project**
   Identify risks and list them in sheet *Risk assessment* involving the team relevant for the project. For the risks identified, each column in the sheet are filled out according to:
   - **Category** - choose the appriopriate category from the list. See sheet *Guidance* for additional guidance on the categories.
   - **Risk source** - briefly note the source for the risk identified. The guidance words in the sheet *Guidance* may be used for brainstorming and identifying risks.
   - **Risk description** - thoroughly describe the risk and the consequences the risk might entail.
   - **Risk area** - choose the appropriate risk area from the list based on the consequences if the risk would materialize. The risk areas are listed in sheet *Instructions* .
   - **Original risk assessment not considering any mitigation** (columns F-H) - The probability for and the impact of the risk are evaluated without considering any mitigation actions. This is only done once, when the risk is identified. In the continued work and reporting columns F-H are hidden and the actual status is updated in columns J-L.
   - **Probability** - evaluate the probability that the risk may occur on a scale 1-4 according to the definitions in sheet *Instructions* .
   - **Impact** - evaluate the impact if the risk would occur on a scale 1-4 according to the definitions in sheet *Instructions* .
   - **Risk rating** - automatically calculated based on the probability and impact assessed.
   - **Risk mitigation and action plan** - note the actions, performed and planned, to mitigate or handle the risks identified. For risks in Risk area S or E, the actions are to involve eliminating all risks rated Impact≥2 due to zero tolerance policy.
   - **Responsible** - note the name of the person responsible for the executing the mitigating actions or monitoring the development of the risk.
   - **Deadline** - note the deadline for mitigation actions.
   - **Status** - choose the appropriate risk handling status from the list: Ongoing - mitigation actions ongoing; Pending - risk identified, mitigation actions pending; Closed - risk has been eliminated and no more monitoring or mitigation actions are needed.
3. **Updating the risk analysis**
   The risk assessment is revised and supplemented in order to reflect the risk exposure at any time, at least
   - ahead of decision gates,
   - ahead of monthy reporting and
   - when the circumstances change affecting the risks exposure in the project.

   Revision of the risk analysis includes identifying and adding risks as well as for already listed risk updating at least the Risk assessment including any mitigation actions taken to date (Probability in column J and Impact in column K), Risk mitigation and action plan, Status. When revising and updating the risk analysis, the team relevant for the project is involved in the work.
4. **Print out**
   When printing the risk assessment, rows 1-2 in sheet *Risk assessment* can be unhidden to include the header with project information from sheet *Cover and revision history* in the print out.

Risk rating	Categorisation	Need for mitigation actions
1 - 2	Minor/acceptable risk	Minimum of action plans and training to the relevant extent if the risk would occur.
3 - 9	Medium/manageable risk	Action plan to be prepared including measures to reduce the probability and/or consequence to a lower risk level. E.g. competence requirements, protective measures or instructions.
12 - 16	Major/unacceptable risk	Risk to be eliminated. E.g. refrain from the activity, remove the risk by changing the solution or comprehensive protective measures.

Impact evaluation

S = Safety and working environment

1. Transient mild discomfort. No absence from work.
2. Mild injuries, permanent discomfort. No absence from work.
3. Occasional cases of serious injuries, severe discomfort. Absence from work.
4. Deaths, several cases of serious injuries.

E = Environment

1. No actual damage. Small spreading, no decontamination need.
2. Minor damage. Small spreading, easy decontamination. Limit value exceeded, which can be remedied with simple efforts.
3. Long-term damage. Larger spreading, demanding decontamination. Limit value exceeded with great risk of plant closure.
4. Permanent damage. Large spreading, difficult or impossible decontamination. Environmental prosecution (exceeded limit value / repeated exceedings of limit values).

P = Project, e.g. cost, time, resource and business risks

1. <10 000 EUR
2. 10 000 - 100 000 EUR
3. 0.1 - 1 MEUR
4. >1 MEUR

Probability evaluation

1. **Unlikely** - Possible but not likely: occurring less than once in 100 years.
2. **Low probability** - May occur, one has heard it has happened: occurring once every 10 to 100 years.
3. **High probability** - Event that is known to have occurred: occurring once every 1
4. **Very high probability** - Common event: occurring more than once a year.

Risk area (impact)

S Safety and working environment
E Environment
P Other, e.g. cost, time, resource and business risks

Figure 6-12 Risk instructions Project 3

- **Procurement Management:**

In the procurement-related activities, we can summarize the process as rechecking the original budget price offered during the Tender Phase against the current prices provided by suppliers. This involves recalculating the cost/budget. While procurement management includes additional activities related to contractual processes and logistics, for the purposes of monitoring and control in project management, we will focus solely on cost/budget updates.

Project 1 and Project 2 used the format presented in Figure 6-13, "Procurement Project 1 and 2." This format allows visualization of the original price offered to customers ("forecast"), a reserved contingency amount, and the final price once confirmed with suppliers. It also includes space to record the supplier's name and areas to calculate the final revenue.

P1		ALV 0%	- €		- €	#NAME?		
Cost Control		1 485 000,00 €	Forecast		Final Price	Bound	OutTurn	revenue
		SUPPLIER NAME		Ylikust. Varaus	1 485 000,00 €			
	Suunnittelu			5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %				
	Työmaa			5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %				
	Betonityöt			5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %				
	Vastaanottosiilo tech			5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %				
	Hygienisointi			5 %	- €	#NAME?		
				5 %				
	Reaktori ja säiliö			5 %	- €	#NAME?		
				5 %				
	Separointi			5 %	- €	#NAME?		
				5 %				
	Lopputuotevarasto			5 %	- €	#NAME?		
				5 %	- €	#NAME?		
				5 %				
	Sähkökattilakontti			5 %	- €	#NAME?		
				5 %				
	Soihtu			5 %	- €	#NAME?		

Figure 6-13 Procurement project 1 and 2

For Project 3, the format provides a detailed list of activities categorized into packages, including a thorough update on the cost/budget for the project's supply needs. This format includes various columns intended for data descriptions, but they have not yet been utilized.

Pos. No.	Subject	Qty. [-]	Dimensions [l x w x h] [m]	Volume/power	Connection to Control unit	Price for Project	Supplier	basic data	basic design	detail design	Installation	Lead Supervision	Jaottelu tenderi Excelissä! SWE	Price	NOTES
	Kokonaisomakustanne:													20,50 % - € - € - €	
	Buildings													- €	Rakennusurakan kilpailutuksessa tämä osio
	Pre-treatment hall													- €	Not included, offered if needed
	Separation area hall													- €	
														- €	
	Equipments and Hardware													- €	
	Pretreatment / Feeding equipment													- €	
	Hammer Mill													- €	
	Hygienization/pasteurization Unit													- €	
	pumps													- €	
	Höyrylaitteisto													- €	
	Heat exchanger, heat after hygi --> before hygi													- €	
	Schmack paketti													- €	
	Concrete Effluent Storage 1													- €	
	Digestate separation													- €	
	Biogas flow Measurement and Analyzer													- €	
	Boiler unit	1												- €	
	Biogas Emergency Flare													- €	
	Biogas pre-treatment													- €	
	Biogas Upgrading													- €	
	CHP													- €	
	Switch and control cabinets													- €	
	Platforms and Walkways													- €	
	Other process equipment, pipes and valves													- €	
														- €	
	Logistics, site arrangements and civil works													-	
	Freight, Packaging, Insurance DAP													- €	
	Site preparation and arrangements													- €	
	Excavation works													- €	
	Construction and Civil works												2 132 029,00	- €	
	Mechanical installations and electrification													-	
	Mechanical installations													- €	
	Electrical and automation installations													- €	
	Pipeling contract 1: underground pipes and works													- €	
	Pipeling contract 2: Aerial													- €	
	Commissioning, project management, site management													-	
	Schmack commissioning, supervision and management													- €	
	Commissioning													- €	
	Project Management and Procurement													- €	
	Construction Site Management													- €	
														- €	
	Design/engineering													-	
	Engineering, Electrical													- €	
	Engineering, Instrumentation & Automation													- €	
	Engineering, Process													- €	
	Engineering, Mechanical & Other													- €	
	Engineering, Schmack													- €	
	Contractors, General Requirements													-	
	Contractors General Requirements													- €	
	Sales agent commission													- €	
	Sales agent commission													2 %	
	EPC Risk Items / Exclusions to be proposed														
	Main equipment														
	Construction, Installation and Commissioning														
	Others														

Figure 6-14 Procurement Project 3

- **Schedule Control:**

The company has implemented scheduling through the use of MS Project, where the project department generally records schedules using the Gantt chart technique, following a base-activity listing approach. Document research has revealed multiple schedules for each project, including design schedules, procurement schedules, and main schedules. For "Project 1," the schedule is structured as a base-activity list, as shown in Figure 6-15"Schedule Project 1."

Figure 6-15 Schedule Project 1

A deeper analysis of the design and procurement schedules has revealed inconsistencies in the activities when they were integrated with the main schedules for "Project 2" and "Project 3." These inconsistencies are illustrated in the following figures for each project. For "Project 2," the schedule was developed using two different tools, MS Excel and MS Project. However, it is important to note that the company currently uses only MS Project.

- Project 2

LAUKSEN STATUS	TOIMITUS-VALMIUS	PROJECT PURCHASING SCHEDULE
		Project week
		Calendar week
		Project month **from NTP**
		EKT contract 23.8.2021 (target point)
		NTP site 1.10.2021 (target point)
		MRU and RAK CONTRACT 1.10.2021
OK	23.5.2022	BUP CONTRACT 17.9.2021
OK	30.5.2022	BIOGAS PROCESS CONTRAC 1.10.2021
		HYGI DESIGN CONTRACT 17.9.2021
		HYGIENIZATION SUPPLIERS FIXED
OK	3.6.2022	HYGIENIZATION EQUIPM. CONTRACTS SIGNED 4.2.2022
		HYGIENIZATION EQUIPM. DELIVERY
		PRE TREATMENT SUPPLIER FIXED 8.11.2021
OK	6.7.2022	PRE TREATMENT AND FEEDING EQ. CONCRACT SIGNED 25.2
		PRE TREATMENT AND FEEDING EQ. DELIVERY DL 23.5.2022
OK	18.5.2022	SEPARATION CONTRACT SIGNED 11.1.2022
		SEPARATION DELIVERY
		BOILER UNIT SUPPLIER FIXED
OK	18.5.2022	BOILER UNIT CONTRACT SIGNED 29.12.2021
		BOILER UNIT DELIVERY
OK	22.6.2022	FLARE CONTRACT SIGNED 10.1.2021
		FLARE DELIVERY
OK	24.5.2022	PUMP CONTRACT SIGNED 4.2.2022
		PUMP DELIVERY
		Site preworks
		MRU digging works
		RAK construction works
		Pretreatment hall
		HVAC and Electricity (feeding hall)
		Construction inspection 23.2.2022 (target point)
		Digesters and liquid fraction tank
OK	OK	Pre-Treatment hall bearings steel structures
OK	OK	Separation hall bearings steel structures
		NTP + 8 months (target point) 1.6.2022 main equipment
		PROS main process equipment installation
		PROS EQUIPMENT INSTALLATION CONTRACT 11.2.2022
		Pros equip RFQ material ready for BWF review 8.2.2022
		Pretreatment hall
		Other areas
		PROS HVAC CONTRACT 23.2.2022
		PROS PIPING CONTRACT 25.3.2022
		Pros piping RFQ material ready for BWF review 15.2.2022
		HVAC and Electricity (process)
		Process piping
		SIA DESIGN CONTRACT 15.12.2021
		SIA DESIGN PROCESS
		SIA INSTALLATION CONTRACT 15.4.2022
		Instrumentation, automation
		Inoculum
		Operation period by BioWoima Finland
		BUP biogas upgrading installation
		BUP ready to take rawgas in (target point)
		Pretreatment, start-up and commissioning
		Whole plant: Commissioning
		Hand over
		3 weeks stable operation period
		Guarantee test period
		Project closing

Figure 6-16 Procurement schedule project 2

General
Design review instructions
Technical specifications
Hazop documentation
Explosive preventation handbook
Schmack documentation
PI&D (preliminary list of all valves, instruments and their sizes)
Project preliminary bill of material (including information about limit switches)
Preliminary equipment weight points and weight information (necessary asap)
Preliminary equipment inlet / outlet sizes and their location
Constraints that purchaser have to fulfill for equipment(s) to work properly (information)
Used automation system including possibilites for data transfer (Profinet etc.)
Preliminary amount of IO's of the provided equipment (necessary asap)
3d model provided in .stp format
Atex documentation from proposed equipment (if applicable)
Atex zone drawings for the provided equipment (if applicable)
Use and maintenance documentation
All components and apparatus shall fulfill demand according directive and law CE-marking and EMC
Technical data sheets of equipment
Authorities inspection documentation (if applicable)
Calibration documentations
Packaging information for delivery
Final PI&D
Final bill of material including equipment plate information
IO list
Hazop reports
HMI information (whether is included)
Detailed process description and automation description
Carbotech documentation
PI&D (preliminary list of all valves, instruments and their sizes)
Project preliminary bill of material (including information about limit switches)
Preliminary equipment weight points and weight information (necessary asap)
Preliminary equipment inlet / outlet sizes and their location
Constraints that purchaser have to fulfill for equipment(s) to work properly (information)
Used automation system including possibilites for data transfer (Profinet etc.)
Preliminary amount of IO's of the provided equipment (necessary asap)
3d model provided in .stp format
Atex documentation from proposed equipment (if applicable)
Atex zone drawings for the provided equipment (if applicable)
Use and maintenance documentation
All components and apparatus shall fulfill demand according directive and law CE-marking and EMC
Technical data sheets of equipment
Authorities inspection documentation (if applicable)
Calibration documentations
Packaging information for delivery
Final PI&D
Final bill of material including equipment plate information
IO list
Hazop reports
HMI information (whether is included)
Detailed process description and automation description
Piping and Mechanical design
Descriptions
3d modeling
Isometric drawings
Support drawings
3d model construction
Plant layout and piping
Atex drawings
Electrical design
Electricity distribution
Equipment layout
Diagrams
Cable lists
Process electrification
Technical specifications
Automation design
field box and panel layouts
Control equipment and box list
Logic diagram (ESD included)
Loop diagrams
PLC and scada design
Process design
Process description
PI&Ds
Equipment lists
SIL study
PED-calculations
Material specifications
RFQs for equipment list
Process design general
FAT testing
Phase 1
Phase 2
SAT testing
Phase 1
Phase 2
Phase 3
Project design upkeep
Design works and change management

Figure 6-17 Design schedule project 2

ID	Task Mode	Task Name	D
1		**16100 End project schedule**	1
2		**Design**	2
3		Heating pipes final design	2
4		Heating distributors design	1
5		Sludge circulation pipe to paddle mill pipe	4
6		Rainwater pipe to paddle mill	2
7		Euco axle heating	4
8		Liquid distributor to paddle mill	1
9		Reporting system	1
10		Sludge distributor	4
11		**Site works**	8
12		Area Asphalt works	1
13		Heat distributors on workshop	3
14		Water accumulator set on place	1
15		Heat distributor installation and connection to boiler	4
16		Flare installation and connection	3
17		Heat distributor connection Schmack and Mapri	3
18		Boiler unit chimney installation	2
19		Water accumulator and water circuit	5
20		Pressure air installation Feeding hall	3
21		Pressure air installation BUP	1
22		Separation hall steel structure	3
23		Separation hall pipe and equipment installation	1
24		Under ground piping (gas and heating) fixed	2
25		Euco installations finalized (inside)	1
26		Euco pump room water circuit installation	3
27		Euco front room plates with flanges	1
28		Other Schmack connection plates	5
29		Valves for inlets and outlets	1
30		Ladder for Euco Roof	1
31		Instrumentation(pressure, temperature)	1
32		Gas collection domes (Euco)	5
33		Inspection windows	1
34		Euco pump room equipment and pipeworks	1
35		Coccus installations finalized (commissioning team)	5
36		Rainwater pump installation	1
37		Sludge pipe to paddle mill with rain water pipe	3
38		Fresh water pipe to paddlemill	1
39		125 m3 vessel connections fixed (inlet, outlet)	2
40		Paddlemill lid installation and finalizing	2
41		**Electrification (Under Valmet supervision)**	3
42		Valmet cabinet cabling	2
43		Control room container	3
44		Schmack biowatch container electrification	2
45		Underground cabling works	2
46		Boiler unit electrification	2
47		Instrument installation	6
48		Instrument cable connections finalized Pretreatment	9
49		Instrument cable connections finalized hygienisation	4
50		Instrument cable connection finished boiler	2
51		Flare electrification (feed)	1
52		**EEM pipeworks finalizing**	1
53		Pipe tightness test	1
54		Hygienisation pipes insulation	8
55		**Mapri works finalized**	
56		**Carbotech EIA installation**	2
57		**Carbotech installations finalized**	
58		**BWF Commissioning**	9
59		Setting up valmet dna	5
60		IO-Testing (hyg/boiler)	5
61		IO-testing (Pretreatment/boiler/Flare/Schmack)	8
62		IO-testing (separation)	2
63		Cold commissioning (pretreatment/hyg/boiler)	1
64		Light Fuel Oil required	1
65		Cold commissioning (Schmack/Flare)	5
66		Cold commissioning (separation)	2
67		Hot commissioning (boiler)	3
68		Hot commissioning (pretreatment/hyg/schmack/flare)	5
69		Hot commissioning Carbotech	5
70		Hot commissioning (separation)	2
71		Total float for commissioning	5
72		**Schmack technical inspection**	1
73		**Inoculum**	1
74		**Biological start-up**	5
75		**Operation period BWF**	3
76		**3 weeks stable operation period**	3
77		**Guarantee test period**	3
78		**Project closing**	3

Figure 6-18 Main schedule project 2

❖ Project 3

16300 VOSS Supplier schedule	826
Outside works	298
Hall construction	279
Main deliveries	486
Biogas technology delivery	375
Biowaste pre-treatment delivery	355
Biogas upgrading (BUP) delivery	382
Biogas compression delivery	332
Decanter centrifuge delivery	271
Odor removal delivery	308
Automation delivery	320
Electrical switchboard delivery	351
Boiler delivery	190
Whole plant: Installations	188
Whole plant: Commissioning	110
Trial operation period	260

Figure 6-19 Procurement schedule project 3

BIR biogas plant
1 Milestones
2 Design/Engineering
2.1 General and basic engineering
2.2 Process design
2.3 Piping and Mechanical design
2.4 HVAC (aligned with Civil works)
2.5 Electrical design
2.6 Automation design
2.7 Civil engineering
2.8 Carbotech documentation
2.9 Schmack documentation
3 Contracts
4 Purchasing
5 Design works and change management

Figure 6-20 Design schedule project 3

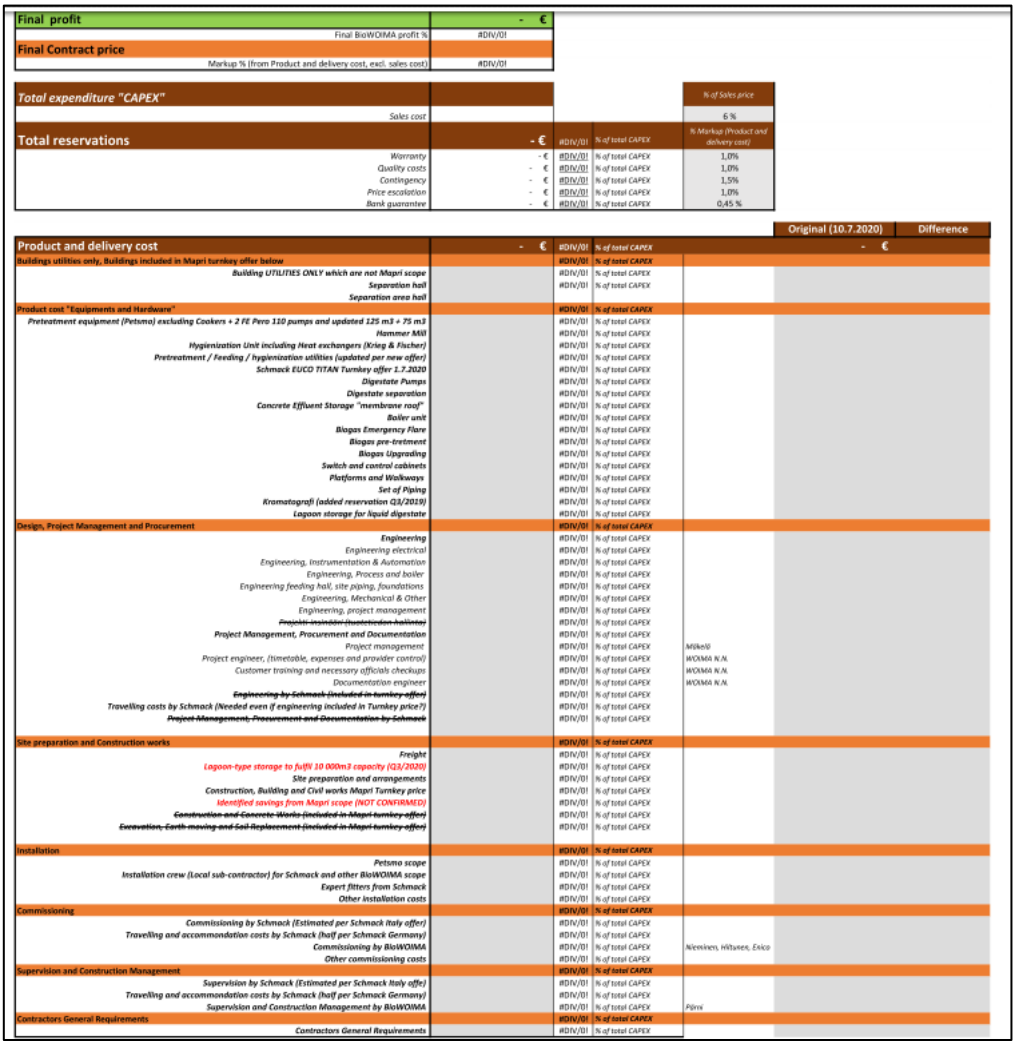
1	Procurement of processing plants	38
12	Application processes	43
17	Construction case	23
23	Design and procurement Building and construction	12
24	Preliminary layout and situation plan	14
25	General design preparation	12
26	General engineering	60
31	Process design	65
38	Piping and Mechanical design	65
46	HVAC and fire fighting design	70
55	Electrical design	65
62	Automation design	45
69	Civil engineering	60
74	Mavitec design	25
95	Schmack documentation	26
116	Carbotech design	36
139	Fornovogas design	57
160	AlfaLaval design	60
181	Pasteurization block & boiler unit design	60
202	Contracts	M
211	Production time & Delivery	48
234	Purchasing	Tu
242	Site (installation, construction)	88
243	Pretreatment and feeding hall	14
254	Biogas reactors, post digestate and liquid fraction	17
274	Biogas upgrading unit	30
278	Boiler unit	20
282	Flaring unit	5 d
285	Pretreatment and feeding system	75
293	Hygienisation	26
299	Outside roads and communications	85
307	Condensate pit	12
311	Rainwater handling	5 d
316	FAT Testing	10
323	SAT Testing	94
331	Design works and change management	
332	Customer invoicing of PROJECT	5 d
340	Invoicing from main suppliers	1 d
382		

Figure 6-21 Main schedule project 3

For this study, we have avoided implementing, improving, or modifying the techniques used in scheduling. This is because the development of the schedule depends on the structure of the work packages and the vision of each project manager, as well as any detailed analysis of the interconnection of activities.

- **Budget:**

The budget has been included in the analysis of this study due to its direct impact on the procurement and cost control formats, the Figure 6-22 Budget format all projects, currently the calculation members of Sales team is using this format, which was inherited from a filial company.



Final profit	- €			
Final BioWOIMA profit %	#DIV/0!			
Final Contract price				
Markup % (from Product and delivery cost, excl. sales cost)	#DIV/0!			
Total expenditure "CAPEX"				*% of Sales price*
Sales cost				6 %
Total reservations	- €	#DIV/0!	% of total CAPEX	% Markup (Product and delivery cost)
Warranty	- €	#DIV/0!	% of total CAPEX	1,0%
Quality costs	- €	#DIV/0!	% of total CAPEX	1,0%
Contingency	- €	#DIV/0!	% of total CAPEX	1,5%
Price escalation	- €	#DIV/0!	% of total CAPEX	1,0%
Bank guarantee	- €	#DIV/0!	% of total CAPEX	0,45 %
				Original (10.7.2020) / Difference
Product and delivery cost	- €	#DIV/0!	% of total CAPEX	- €
Buildings utilities only, Buildings included in Mapri turnkey offer below		#DIV/0!	% of total CAPEX	
Building UTILITIES ONLY which are not Mapri scope		#DIV/0!	% of total CAPEX	
Separation hall		#DIV/0!	% of total CAPEX	
Separation area hall				
Product cost "Equipments and Hardware"		#DIV/0!	% of total CAPEX	
Pretreatment equipment (Petsmo) excluding Cookers + 2 FE Pero 110 pumps and updated 125 m3 + 75 m3		#DIV/0!	% of total CAPEX	
Hammer Mill		#DIV/0!	% of total CAPEX	
Hygienization Unit including Heat exchangers (Krieg & Fischer)		#DIV/0!	% of total CAPEX	
Pretreatment / Feeding / hygienization utilities (updated per new offer)		#DIV/0!	% of total CAPEX	
Schmack EUCD TITAN Turnkey offer 1.7.2020		#DIV/0!	% of total CAPEX	
Digestate Pumps		#DIV/0!	% of total CAPEX	
Digestate separation		#DIV/0!	% of total CAPEX	
Concrete Effluent Storage "membrane roof"		#DIV/0!	% of total CAPEX	
Boiler unit		#DIV/0!	% of total CAPEX	
Biogas Emergency Flare		#DIV/0!	% of total CAPEX	
Biogas pre-tretment		#DIV/0!	% of total CAPEX	
Biogas Upgrading		#DIV/0!	% of total CAPEX	
Switch and control cabinets		#DIV/0!	% of total CAPEX	
Platforms and Walkways		#DIV/0!	% of total CAPEX	
Set of Piping		#DIV/0!	% of total CAPEX	
Kromatografi (added reservation Q3/2019)		#DIV/0!	% of total CAPEX	
Lagoon storage for liquid digestate		#DIV/0!	% of total CAPEX	
Design, Project Management and Procurement		#DIV/0!	% of total CAPEX	
Engineering		#DIV/0!	% of total CAPEX	
Engineering electrical		#DIV/0!	% of total CAPEX	
Engineering, Instrumentation & Automation		#DIV/0!	% of total CAPEX	
Engineering, Process and boiler		#DIV/0!	% of total CAPEX	
Engineering feeding hall, site piping, foundations		#DIV/0!	% of total CAPEX	
Engineering, Mechanical & Other		#DIV/0!	% of total CAPEX	
Engineering, project management		#DIV/0!	% of total CAPEX	
~~*Projekti- insinöörityöt (hankintojen hallinta)*~~		#DIV/0!	% of total CAPEX	
Project Management, Procurement and Documentation		#DIV/0!	% of total CAPEX	
Project management		#DIV/0!	% of total CAPEX	Mikeli0
Project engineer, (timetable, expenses and provider control)		#DIV/0!	% of total CAPEX	WOIMA N.N.
Customer training and necessary officials checkups		#DIV/0!	% of total CAPEX	WOIMA N.N.
Documentation engineer		#DIV/0!	% of total CAPEX	WOIMA N.N.
~~***Engineering by Schmack (included in turnkey offer)***~~		#DIV/0!	% of total CAPEX	
Travelling costs by Schmack (Needed even if engineering included in Turnkey price?)		#DIV/0!	% of total CAPEX	
~~***Project Management, Procurement and Documentation by Schmack***~~		#DIV/0!	% of total CAPEX	
Site preparation and Construction works		#DIV/0!	% of total CAPEX	
Freight		#DIV/0!	% of total CAPEX	
Lagoon-type storage to fulfil 10 000m3 capacity (Q3/2020)		#DIV/0!	% of total CAPEX	
Site preparation and arrangements		#DIV/0!	% of total CAPEX	
Construction, Building and Civil works Mapri Turnkey price		#DIV/0!	% of total CAPEX	
Identified savings from Mapri scope (NOT CONFIRMED)		#DIV/0!	% of total CAPEX	
~~***Construction and Concrete Works (included in Mapri turnkey offer)***~~		#DIV/0!	% of total CAPEX	
~~***Excavation, Earth moving and Soil Replacement (included in Mapri turnkey offer)***~~		#DIV/0!	% of total CAPEX	
Installation		#DIV/0!	% of total CAPEX	
Petsmo scope		#DIV/0!	% of total CAPEX	
Installation crew (Local sub-contractor) for Schmack and other BioWOIMA scope		#DIV/0!	% of total CAPEX	
Expert fitters from Schmack		#DIV/0!	% of total CAPEX	
Other installation costs		#DIV/0!	% of total CAPEX	
Commissioning		#DIV/0!	% of total CAPEX	
Commissioning by Schmack (Estimated per Schmack Italy offer)		#DIV/0!	% of total CAPEX	
Travelling and accommondation costs by Schmack (half per Schmack Germany)		#DIV/0!	% of total CAPEX	
Commissioning by BioWOIMA		#DIV/0!	% of total CAPEX	Nieminen, Hiltunen, Esico
Other commissioning costs		#DIV/0!	% of total CAPEX	
Supervision and Construction Management		#DIV/0!	% of total CAPEX	
Supervision by Schmack (Estimated per Schmack Italy offe)		#DIV/0!	% of total CAPEX	
Travelling and accommondation costs by Schmack (half per Schmack Germany)		#DIV/0!	% of total CAPEX	
Supervision and Construction Management by BioWOIMA		#DIV/0!	% of total CAPEX	Pirni
Contractors General Requirements		#DIV/0!	% of total CAPEX	
Contractors General Requirements		#DIV/0!	% of total CAPEX	

Figure 6-22 Budget format all projects

- **Cost Control/ cashflow:**

Cost management is a comprehensive term encompassing various estimating methods to predict necessary resources and perform cost estimation. It involves budgeting, forecasting cash flow, funding the budget, controlling expenses, and conducting post-project evaluations to identify future cost-saving opportunities.

The company uses activity-based costing (ABC) and follows a cash flow registration approach. This cost control technique assigns overhead and indirect costs to related products and services, recognizing the relationship between costs, overhead activities, and manufactured products. It assigns indirect costs to products in a less arbitrary manner than traditional cost control methods. However, a challenge with this technique is the difficulty in assigning indirect costs, such as management and office staff salaries, to specific products.

The visualization of this technique will be included in Annex C. This technique was used in Projects 2 and 3; no documentation was found for Project 1. In the cost control of Project 2, a graphical cash flow forecast based on the registered activities was identified. In Project 3, a graph was found showing a cash flow forecast based on payment agreements with the customer and a graph of planned and realized expenses with four variables: Plan/Month, Actual Month (in the accounting tool Talenom), Budget Cumulative, and Actual Cumulative in Talenom.

6.2.2 Selection of tools and techniques

Based on the documentation presented earlier, this section focuses on selecting tools and techniques designed to enhance the monitoring and control process at Biovoima. The decisions are grounded in findings from interviews and the company's technical needs. All proposed improvements have been presented to the project management department and the subsidiary departments involved in the activities.

Additionally, it is intended to unify the style of company formats by incorporating the palette of colors associated with the company's image.

- **Issue Management:**

An issue log is a crucial project document that assists the project manager in addressing these issues. Issues are unexpected problems, gaps, inconsistencies, or conflicts that arise during the project's lifecycle. These can involve staff or supplier problems, technical failures, material shortages, or any other issues negatively impacting the project. If unresolved, issues can lead to unnecessary conflicts, delays, or failures in delivering project outcomes. Additionally, issues can affect stakeholder expectations. A risk, on the other hand, is an uncertain event or condition that could positively or negatively impact at least one project objective if it occurs. In contrast, an issue is already affecting the project and requires resolution. Therefore, issue management is reactive and demands immediate tactical action. (Pradip, 2023)

The provided figure Figure 6-23 illustrates the suggested format to be included in control and monitoring activities. In this format, the identification of potential impact, issue owners, and the dates of opening and closure are essential for determining the priority level of the issue. Registering the issues also provides the opportunity to identify potential lessons learned for future projects.

BIOVOIMA

Issue Tracking

Tool version: 1.0

Project:

Date Last Review:

Project Manager:

ID	Description	Potencial Impact	Priority	Dated Opened	Dated Closed	Issue Owner	Status	Notes
			Low				Open	
			Medium				Closed	
			High					
			Critical					

Figure 6-23 Issue Log tracking

- **Requirements Management:**

  Requirements management involves a series of techniques aimed at documenting, analyzing, prioritizing, and agreeing on requirements. This ensures that engineering teams always work with current and approved requirements. Clear, concise, and error-free requirements help engineering teams detect errors early, thus reducing project costs and risks. To facilitate this process, a High-Level Plan was developed to create a path of activities and

deliverables divided by stages. This document can be found in Appendices (1,2, 3 and 4), and was designed with consideration for projects of different sizes. However, this data does not specify the requirements in detail for design and engineering, those will be provided by the respective department and tailored according to the needs of each project.

The clarification on how to evaluate the gates that determine the change of management will be decided by the company. While some companies may mark these gates by completing milestones, during the maturation of this study, an agreement on the specific markers for closing stages could not be reached with the company.

- **Change Control Management:**

  The design of the new format was primarily focused on aligning with the company's standardization of formats, including colors and design elements, based on the old format. The previous format was notably effective and well-received by team members. However, instructions for implementing this process were not documented or defined. Therefore, they are described as follows:

  "The term 'change management' refers to the actions, tools, and models implemented to manage different types of change, either at the project or organizational level. In Suomen Biovoima, project-related change management mainly covers the management of:

  i. Cost and/or schedule-related deviations from the original project scope (not considered in the original cost calculation)
  ii. Additional works sold to the customer
  iii. Such deviations from the original project scope which don't necessarily create a cost or schedule-related changes

  The change management tool will provide a running numbering for each change works with as start number of CM001 (CM stands for Change Management) and MH001 in Finnish projects (MH stands for Muutoshallinta).

  The columns that are always filled are the following for each change work:

  - CM-number
  - Date
  - Description
  - Change type (additional work or simpler scope work)
  - Status of the work (accepted, rejected, in progress, closed) with color codes
  - Cost of the change, estimated

- Price to the customer
- Cost price, realized
- Contract in which the change belongs to (for example construction, HVAC, electrical design)
- Contractor
- Does the change work trigger/need a contract amendment (yes/no)
- What is the schedular effect of the change work
- Has the additional work been invoiced (yes/no)
- Additional information of the change work

A blank change management tool is always established in the beginning of the project into the Change Management folder. If any CM-change work involves any additional documents (say, additional work price calculations or subcontractor documents), they will be saved into a sub-folder named the CM-number + short description of the change work.

Upkeeping and updating the change management tool is on project manager's responsibility."

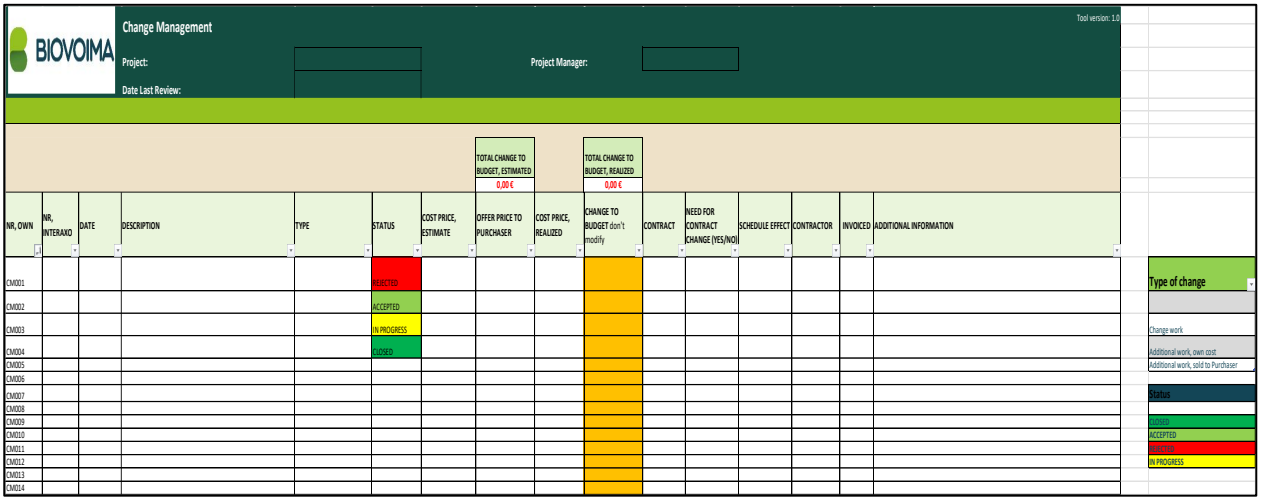


Figure 6-24 Change Management New Format

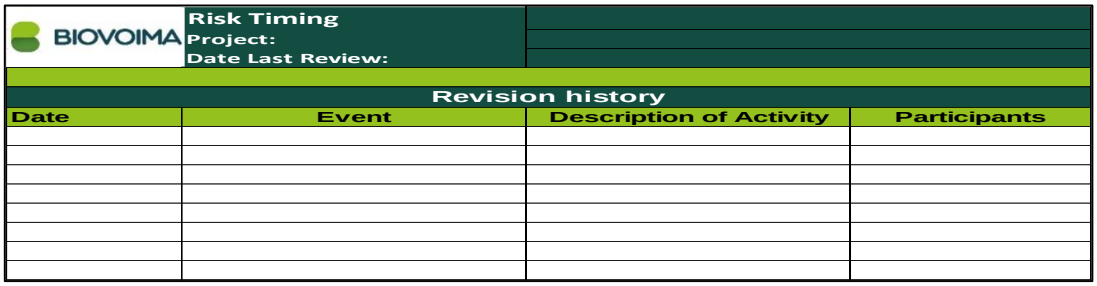
- **Risk Management:**

  After evaluating the format used in Project 3, it was decided to employ the same methodology and enhance the book format, continuing with the Excel tool. New sheets were added with the aim of facilitating the visualization of risk, progressing from a basic perspective to a more complex one, such as the "Risk Assessment" sheet.

  The first added sheet was "Risk Timing," intended to record each risk assessment during the project lifecycle. The second addition was "Risk Owners," where the names of all risk

owners would be listed to facilitate locating and assigning activities when implementing mitigation plans.

The last addition was "Risk Registration," aiming to suggest risks directly and provide an initial description of their impact and potential risk response, without yet categorizing them. This approach aims to avoid limiting brainstorming during risk assessments. Once the risk registration is completed, a more accurate and detailed risk assessment can be conducted using the subsequent sheet, "Risk Assessment." This sheet was modified only in design to align with company standardization. The last three sheets (Instructions, Guidance, Risk WBS) remained unchanged.



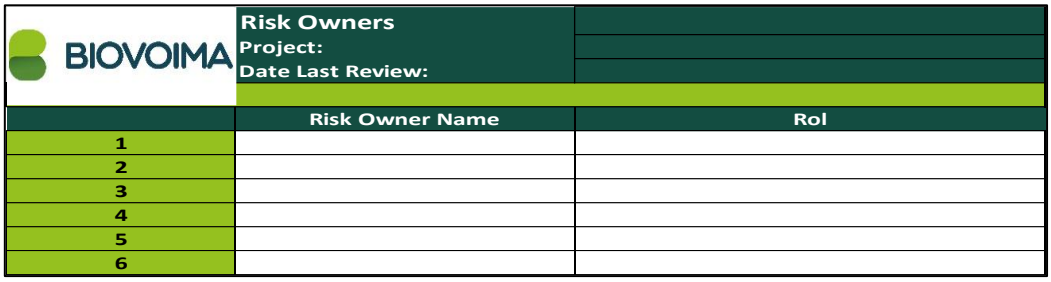
BIOVOIMA

Risk Timing
Project:
Date Last Review:

Revision history

Date	Event	Description of Activity	Participants

Figure 6-25 Risk timing NF

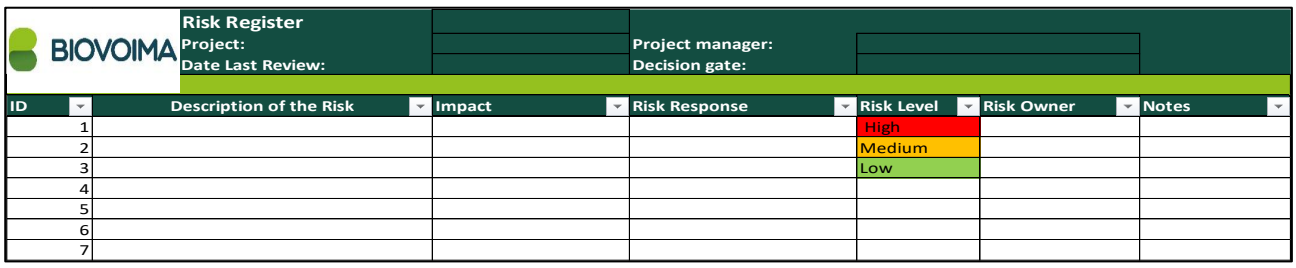


BIOVOIMA

Risk Owners
Project:
Date Last Review:

	Risk Owner Name	RoI
1		
2		
3		
4		
5		
6		

Figure 6-26 Risk Owners NF



BIOVOIMA

Risk Register
Project:
Date Last Review:
Project manager:
Decision gate:

ID	Description of the Risk	Impact	Risk Response	Risk Level	Risk Owner	Notes
1				High		
2				Medium		
3				Low		
4						
5						
6						
7						

Figure 6-27 Risk Register NF

Figure 6-28 Risk WBS NF

For the purpose of this thesis as well was developed a format for the Risk Management plan named “Risk Management Plan.docx”, this document will be base for future subsidiary plans of the main Project Plan.

- **Procurement Management:**

  The procurement tool underwent modifications initially by reordering the columns and then adding new columns such as "Units" to clarify the type of calculation (e.g., meter, unit, work hours) and "Price per unit" for more detailed records of calculations. The "Subject" list was expanded to level 4 detail, and it was agreed with the procurement manager that this format would serve as the base for future projects due to its detailed description of each subject.

  A second sheet named "Categories" was added to the workbook to identify categories using numbers in the main sheet, thus defining the work package type. Due to company privacy concerns, Figure 6-29, "Procurement NF," only displays detail up to level 1. Additionally, the format design was aligned with the company's image.

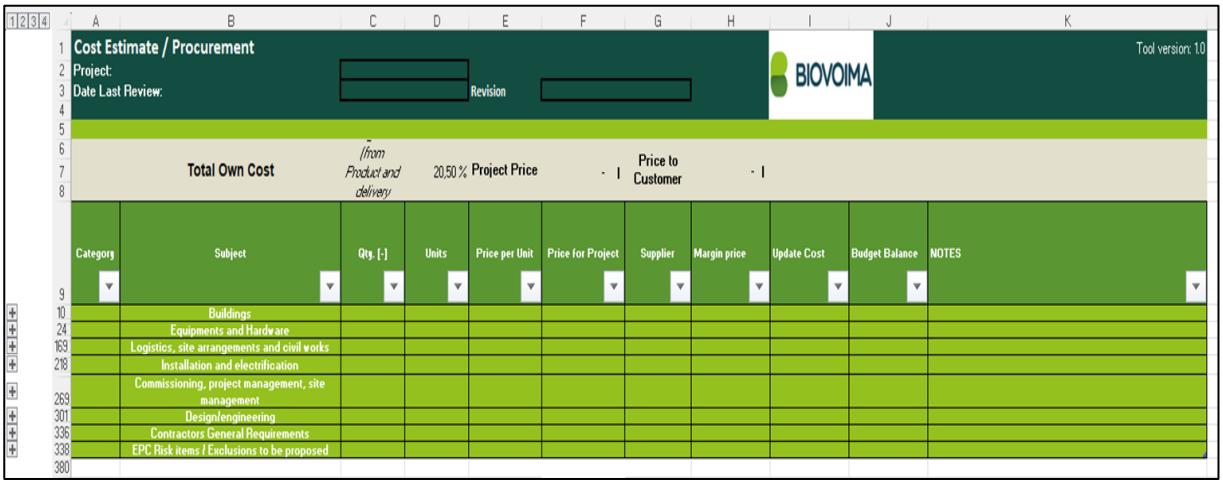


Figure 6-29 Procurement NF

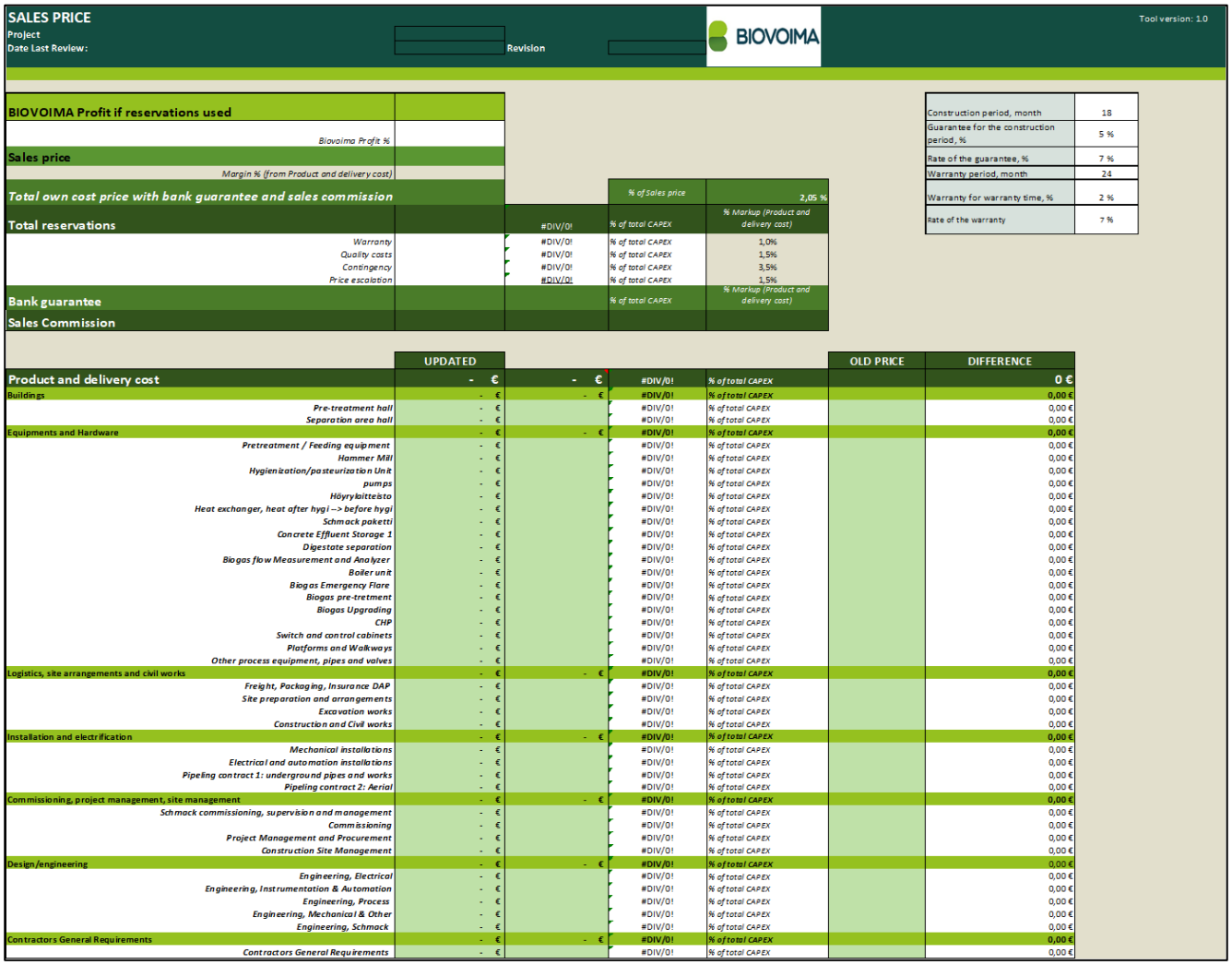
CATEGORY	DESCRIPTION
1	Supplier contract
2	Biovoima machines part 1
3	Biovoima machines part 2
4	Project managment
5	Commissioning (own)
6	Engineering
7	Biovoima installations
8	Financial costs Bank quarantee
9	Sales commission
10	Spare parts
11	Site and assembly management

Figure 6-30 Procurement categories NF

- **Budget:**

  The format underwent several modifications: the "Total Expenditure" box was renamed to "Total Own Cost Price with Bank Guarantee and Sales Commissioning," and the "Total Reservation" box was adjusted by removing "Valuation Risk" and separating "Bank Guarantee" into a separate calculation box. No changes were made to the "Product and Delivery Cost" items. Overall, the design format was aligned with the company's image.

  The "Budget" workbook includes a second sheet called "Cost Estimate," where detailed product calculations are made in the "Subject" column. Initially provided by the sales department, this format is then utilized by procurement to update processes. The format resembles the one used in procurement, with level 4 detail being identical, facilitating data merging between departments. All formulas in the workbook were verified, but calculations are not displayed to protect company data.



SALES PRICE

Project

Date Last Review:

Revision

BIOVOIMA

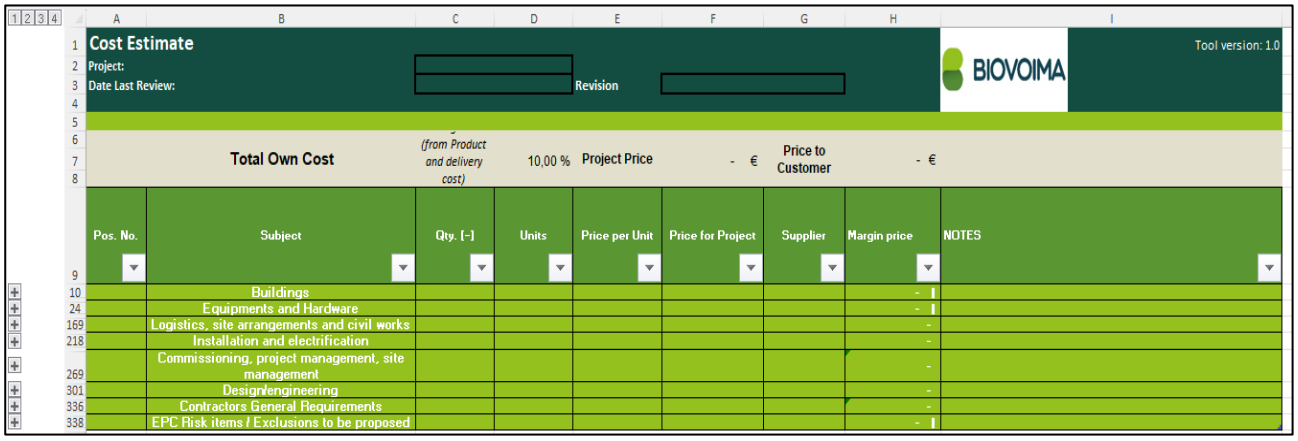
Tool version: 1.0

BIOVOIMA Profit if reservations used				
Biovoima Profit %				
Sales price				
Margin % (from Product and delivery cost)				
Total own cost price with bank guarantee and sales commission			% of Sales price	2,05 %
Total reservations		#DIV/0!	% of total CAPEX	% Markup (Product and delivery cost)
Warranty		#DIV/0!	% of total CAPEX	1,0%
Quality costs		#DIV/0!	% of total CAPEX	1,5%
Contingency		#DIV/0!	% of total CAPEX	3,5%
Price escalation		#DIV/0!	% of total CAPEX	1,5%
Bank guarantee			% of total CAPEX	% Markup (Product and delivery cost)
Sales Commission				

Construction period, month	18
Guarantee for the construction period, %	5 %
Rate of the guarantee, %	7 %
Warranty period, month	24
Warranty for warranty time, %	2 %
Rate of the warranty	7 %

Product and delivery cost	UPDATED				OLD PRICE	DIFFERENCE
	- €	- €	#DIV/0!	% of total CAPEX		0 €
Buildings	- €	- €	#DIV/0!	% of total CAPEX		0,00 €
Pre-treatment hall	- €		#DIV/0!	% of total CAPEX		0,00 €
Separation area hall	- €		#DIV/0!	% of total CAPEX		0,00 €
Equipments and Hardware	- €	- €	#DIV/0!	% of total CAPEX		0,00 €
Pretreatment / Feeding equipment	- €		#DIV/0!	% of total CAPEX		0,00 €
Hammer Mill	- €		#DIV/0!	% of total CAPEX		0,00 €
Hygienization/pasteurization Unit	- €		#DIV/0!	% of total CAPEX		0,00 €
pumps	- €		#DIV/0!	% of total CAPEX		0,00 €
Höyrylaitteisto	- €		#DIV/0!	% of total CAPEX		0,00 €
Heat exchanger, heat after hygi --> before hygi	- €		#DIV/0!	% of total CAPEX		0,00 €
Schmack paketti	- €		#DIV/0!	% of total CAPEX		0,00 €
Concrete Effluent Storage 1	- €		#DIV/0!	% of total CAPEX		0,00 €
Digestate separation	- €		#DIV/0!	% of total CAPEX		0,00 €
Biogas flow Measurement and Analyzer	- €		#DIV/0!	% of total CAPEX		0,00 €
Boiler unit	- €		#DIV/0!	% of total CAPEX		0,00 €
Biogas Emergency Flare	- €		#DIV/0!	% of total CAPEX		0,00 €
Biogas pre-tretment	- €		#DIV/0!	% of total CAPEX		0,00 €
Biogas Upgrading	- €		#DIV/0!	% of total CAPEX		0,00 €
CHP	- €		#DIV/0!	% of total CAPEX		0,00 €
Switch and control cabinets	- €		#DIV/0!	% of total CAPEX		0,00 €
Platforms and Walkways	- €		#DIV/0!	% of total CAPEX		0,00 €
Other process equipment, pipes and valves	- €		#DIV/0!	% of total CAPEX		0,00 €
Logistics, site arrangements and civil works	- €	- €	#DIV/0!	% of total CAPEX		0,00 €
Freight, Packaging, Insurance DAP	- €		#DIV/0!	% of total CAPEX		0,00 €
Site preparation and arrangements	- €		#DIV/0!	% of total CAPEX		0,00 €
Excavation works	- €		#DIV/0!	% of total CAPEX		0,00 €
Construction and Civil works	- €		#DIV/0!	% of total CAPEX		0,00 €
Installation and electrification	- €	- €	#DIV/0!	% of total CAPEX		0,00 €
Mechanical installations	- €		#DIV/0!	% of total CAPEX		0,00 €
Electrical and automation installations	- €		#DIV/0!	% of total CAPEX		0,00 €
Pipeling contract 1: underground pipes and works	- €		#DIV/0!	% of total CAPEX		0,00 €
Pipeling contract 2: Aerial	- €		#DIV/0!	% of total CAPEX		0,00 €
Commissioning, project management, site management	- €	- €	#DIV/0!	% of total CAPEX		0,00 €
Schmack commissioning, supervision and management	- €		#DIV/0!	% of total CAPEX		0,00 €
Commissioning	- €		#DIV/0!	% of total CAPEX		0,00 €
Project Management and Procurement	- €		#DIV/0!	% of total CAPEX		0,00 €
Construction Site Management	- €		#DIV/0!	% of total CAPEX		0,00 €
Design/engineering	- €	- €	#DIV/0!	% of total CAPEX		0,00 €
Engineering, Electrical	- €		#DIV/0!	% of total CAPEX		0,00 €
Engineering, Instrumentation & Automation	- €		#DIV/0!	% of total CAPEX		0,00 €
Engineering, Process	- €		#DIV/0!	% of total CAPEX		0,00 €
Engineering, Mechanical & Other	- €		#DIV/0!	% of total CAPEX		0,00 €
Engineering, Schmack	- €		#DIV/0!	% of total CAPEX		0,00 €
Contractors General Requirements	- €	- €	#DIV/0!	% of total CAPEX		0,00 €
Contractors General Requirements	- €		#DIV/0!	% of total CAPEX		0,00 €

Figure 6-31 Budget / sales price NF



Cost Estimate

Project:

Date Last Review:

Revision

BIOVOIMA

Tool version: 1.0

Total Own Cost (from Product and delivery cost) 10,00 % Project Price - € Price to Customer - €

Pos. No.	Subject	Qty. [-]	Units	Price per Unit	Price for Project	Supplier	Margin price	NOTES
10	Buildings						-	
24	Equipments and Hardware						-	
169	Logistics, site arrangements and civil works						-	
218	Installation and electrification						-	
269	Commissioning, project management, site management						-	
301	Design/engineering						-	
336	Contractors General Requirements						-	
338	EPC Risk items / Exclusions to be proposed						-	

Figure 6-32 Cost Estimated / Budget NF

- **Cost Control/ cashflow:**

  The format for cost control/cash flow has been mainly modified in design, aiming for standardization of formats aligned with the company's image, as well as for graphic design. Project managers manually handle the cost control of the projects, with data imported from the Talenom tool, and update the formats every two weeks. No potential improvements have been identified for this activity due to limitations of the accountable system. However, it is expected that this format will be used in the automation of reports for the purpose of this study.

BIOVOIMA

CASHFLOW
Project
Date Last Review:
Average payment time: 30 DAYS

Deal signed

Tool version: 1.0

CASHFLOWS IN				M1 + M2					
		Month		July			September	October	November	December
	Total sum		May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
BIR										
Check (should be zero)										
Total										

CASHFLOW OUT, SUPPLIERS		Month							
Purchases	Total sum		May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
Schmack										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
CarboTech										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
MaviTech										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Fornovo Gas										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Alfa-Laval										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Valmet										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Centiair										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Boiler										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Westcome										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Progeco										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Biovoima machines part 1										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Pump supplier										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Biovoima machines part 2										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Biovoima installations										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Spare parts										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Company X										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Company F										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Company J										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Purchases total			**0 €**	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**

CASHFLOW OUT, SALARIES AND SERVICES		Month							
	Total sum		May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
Project and design managment (own)			2,22 %	2,22 %	2,22 %	2,22 %	2,22 %	2,22 %	2,22 %	2,22 %
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Site management										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Trial operation										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Travel costs (own)			2,22 %	2,22 %	2,22 %	2,22 %	2,22 %	2,22 %	2,22 %	2,22 %
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Commissioning (own)										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Commissioning (variable)										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Engineering						5,0 %	5,0 %	5,0 %	5,0 %	5,0 %
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Other										
Check (should be zero)			- €	- €	- €	- €	- €	- €	- €	- €
Sales commission			- €							
Financial costs Bank guarantee			- €							
Own costs total	0		**0 €**	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**

CASHFLOW AT START		Month							
	0		May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
Change			0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
Cumulative			**0 €**	**0 €**	**0 €**	**0 €**	**0 €**	**0 €**	**-1 €**	**-1 €**
Plan/month			0 €	0 €	0 €	0 €	0 €	0 €	0 €	0 €
Actual/month Talenom			- €	- €	- €	- €	- €	- €	- €	- €
Budget										
Budget cumulative			0 €	0 €	0 €	0 €	0 €	0 €	1 €	1 €
Actual cumulative Talenom										

Figure 6-33 ChassFlow NF

6.3 Section 3: Project management reports

6.3.1 Presentation of previous formats

During the research, several formats were identified. The first, the "Project Progress Report," was used in Project 3 to report to the Customer. This format, provided by the Customer, can be seen in Annex D. The second format was found in Project 1 and closely resembles a format given by one of the Project Managers. However, this format is not currently used by the department. The document, titled "Minutes of Meeting - Project Team," is in MS Word format and its content is summarized in Figure 6-34. Although this format aligns with the company's visual design, its content is not suitable for implementation as a standard format across all company projects.

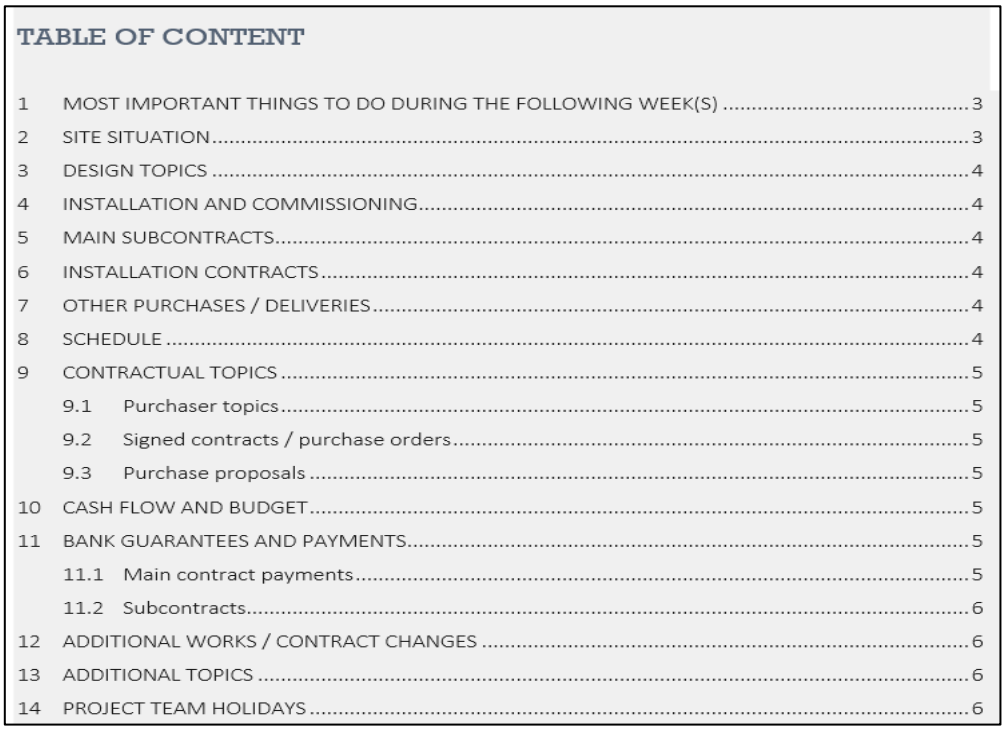


TABLE OF CONTENT

1 MOST IMPORTANT THINGS TO DO DURING THE FOLLOWING WEEK(S) 3
2 SITE SITUATION 3
3 DESIGN TOPICS 4
4 INSTALLATION AND COMMISSIONING 4
5 MAIN SUBCONTRACTS 4
6 INSTALLATION CONTRACTS 4
7 OTHER PURCHASES / DELIVERIES 4
8 SCHEDULE 4
9 CONTRACTUAL TOPICS 5
9.1 Purchaser topics 5
9.2 Signed contracts / purchase orders 5
9.3 Purchase proposals 5
10 CASH FLOW AND BUDGET 5
11 BANK GUARANTEES AND PAYMENTS 5
11.1 Main contract payments 5
11.2 Subcontracts 6
12 ADDITIONAL WORKS / CONTRACT CHANGES 6
13 ADDITIONAL TOPICS 6
14 PROJECT TEAM HOLIDAYS 6

Figure 6-34 Content report format

Project Managers have been using MS PowerPoint as the primary tool for presenting project reports. The department submits a report to the Management Team monthly, while the Project Managers report to the Project Manager Leader in a bi-weekly meeting.

In the Management Team report, the Project Leader provides a comprehensive overview of the allocation of working hours by project, a portfolio summary, and a detailed presentation for each project using the format shown in Figure 6-35. Finally, they present a report on "procurement proposals," which was the third format found in the database.

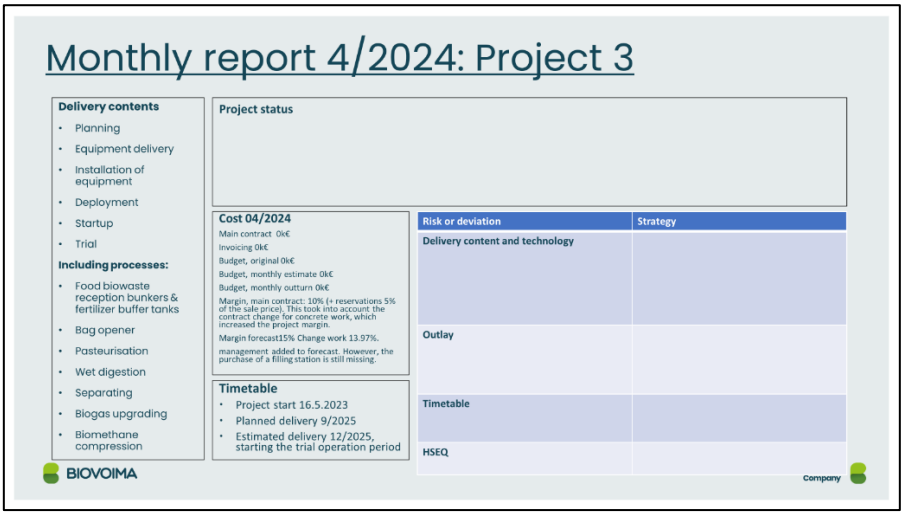


Figure 6-35 Monthly report format

During the bi-weekly project management report, each Project Manager provides an update on their projects and fills in the information using the format shown in Figure 6-36. This is the fourth and final format found in the database.

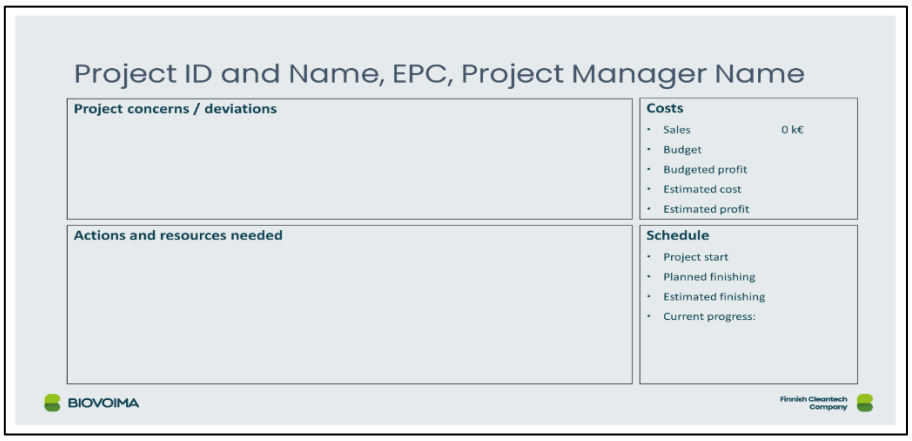


Figure 6-36 Bi-weekly repot format

6.3.2 Presentation of new formats

Based on the needs of the department and two of the three reports established for internal company purposes, it was decided to develop a report format in MS Word and a PowerPoint presentation format for the Team Management Meeting. These formats will summarize the most important data and updates of the portfolio projects. This report is planned to be prepared once a month and presented by the Project Manager Leader. The content for the Word format is defined as shown in **Error! Reference source not found.**, allowing flexibility to include as many projects as necessary. Right side provides a preview of the guidelines for completing the required project information, based on the company's control management formats and needs.

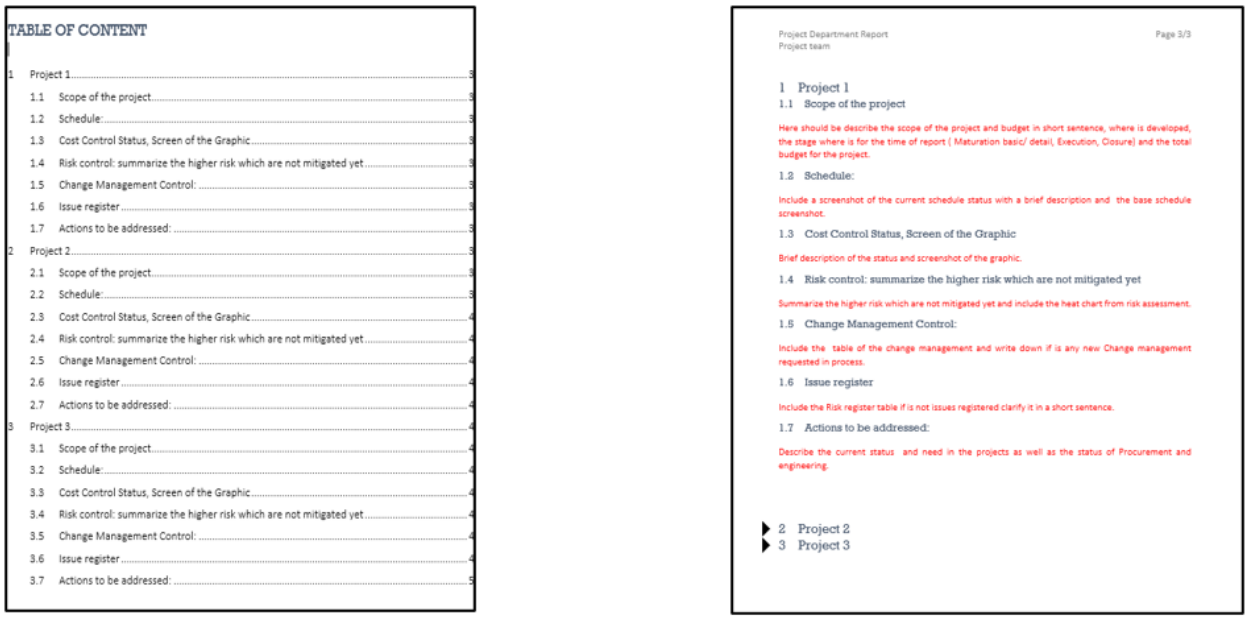


Figure 6-37 and descrption Project department report content

The PowerPoint presentation format was designed as shown in Figure 6-38 and Figure 6-39. One slide includes the allocation of "working" hours per project and the total calculation to facilitate the cost calculation for the project management department. The subsequent slides serve as the base format for presenting the detailed status of the projects. These slides cover the scope description, schedule, risk management, financial status, and key tasks to be executed. Small boxes

containing key data for identifying the projects are placed at the top of the slide. These include the type of project, definition level (based on Figure 6-7. Process flow in HLP), Project Manager's name, total investment of the project, start and end dates, and the project status—red for delayed or over budget, orange for tight budget or schedule, and green for on track as planned.

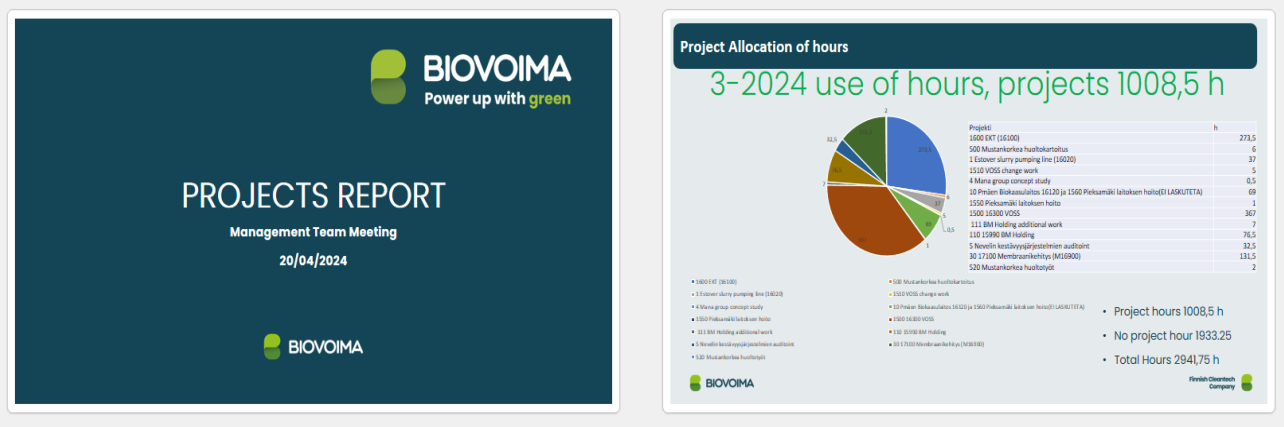


Figure 6-38 PP Management Team report 1

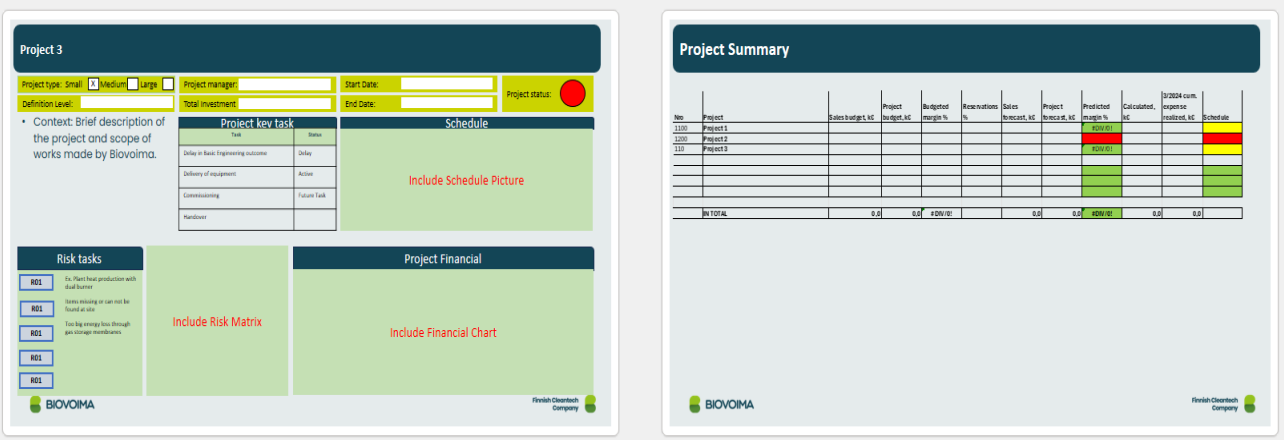


Figure 6-39 PP Management Team report 2

The slide called “Project Summary” belonging to Figure 6-39 PP Management Team report 2, give an overall view of the financial and schedule statutes with the table included. Figure 6-40 present an ideal visualization of the projects report slides one is fulfilled with the project data registered in the Control management formats.

Figure 6-40 PP Management Team report Ideal Presentation

The second PowerPoint format developed is intended for the bi-weekly project management team meeting. This presentation format (see Figure 6-41) is designed to provide a detailed status update on each project to the Project Manager Leader, presented by the Project Managers and team members.

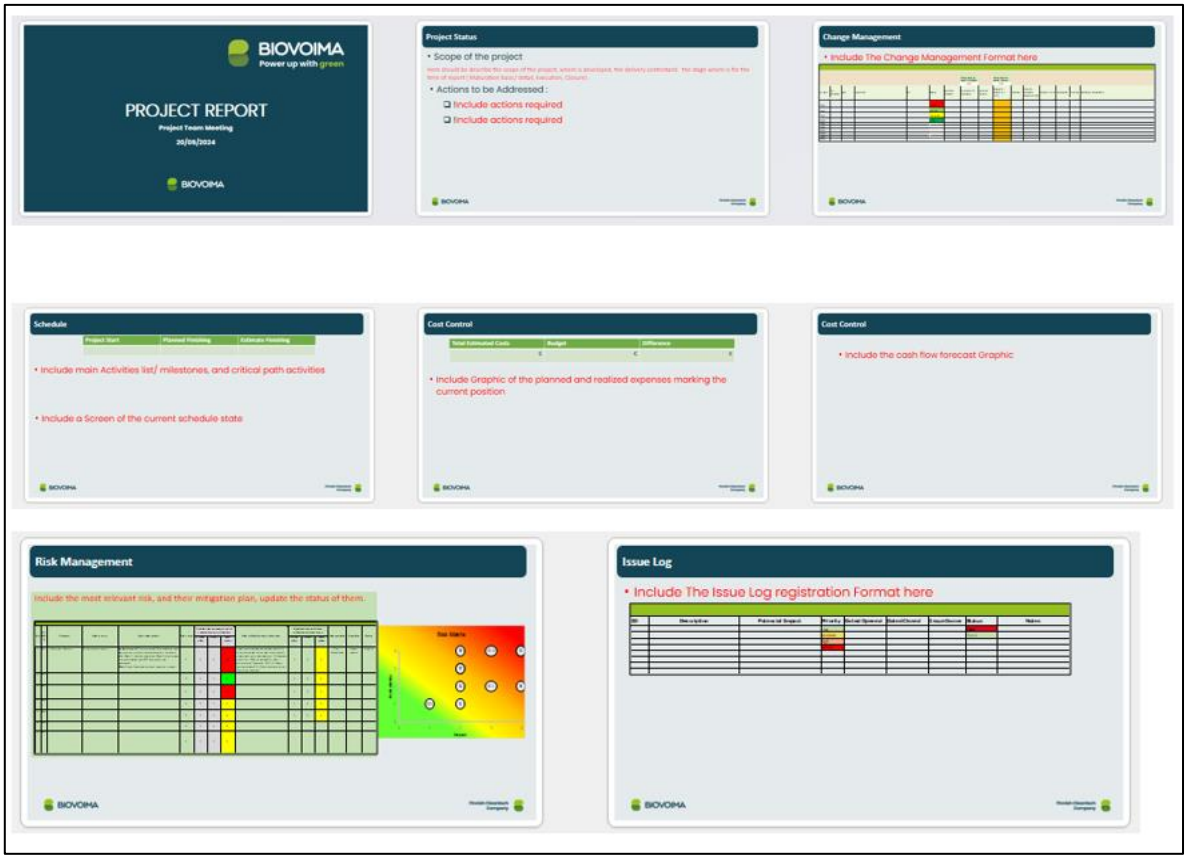


Figure 6-41 Project team meeting Presentation

This report presentation is expected to include the formats developed and presented in section 6.2.2, "Selection of Tools and Techniques," as mechanisms of Monitoring and Control.

6.3.3 Reports automation

The automation was implemented according to the instructions provided in section 5.3. Data from the old files, discussed in section 6.3.1, were migrated to the new format files (see section 6.3.2). All formats were stored in desktop folders and uploaded to the project teams' repositories as part of the implementation.

The report formats were updated with the most recent data by linking objects such as graphics, charts, tables, and data. The information was linked from the updated new formats. However, the automation was limited to files stored in the desktop repository because the team's SharePoint currently does not support direct automation from the cloud, as the "special paste" option is unavailable.

The original document owner, likely the Project Manager, can access and view the document (e.g., Project Team Report) from the cloud by navigating to "File > Info > Open in Desktop App > Update Links." This will enable the automation of every link stored in the original desktop file.

It is also recommended to enable the "Autosave" option, which should be connected to your company email or any email with access to SharePoint, ensuring immediate synchronization with the Cloud repository. This will ensure that any manual modifications are also updated.

When viewing the file from SharePoint using the "Open in Desktop App" option, the original files can be opened by double-clicking the desired linked information.

6.3.3.1 Reminders

This study provides a brief list of the most relevant reminders considered to be taken into contemplation over the Automation of the files.

a) Keep the original files linked to the automated file on your desktop.
b) Maintain the original file's location without modification. Otherwise, the links will need to be updated manually using the "edit link to files" action (refer to Figure 5-7).
c) If you need to save a file before updating the link or from different updates (e.g., weekly reports with varying data), remember to store a copy with a different name and break the links if necessary.
d) If you want to maintain the links but avoid updates, select "No" in the emergent tab (see Figure 5-6).

7 Results / Analysis

7.1 Analysis post implementation

Main Aim

This thesis aims to optimize project management tools and internal processes. During multiple discussions with members of the project management team and company members, a lack of clarity was identified regarding the general project management process and the techniques used to monitor and control projects, as evident in the interviews.

Development of Project Management Process

During the research, a comprehensive project management process tailored to the company's needs was developed. This provided a clear vision of the stages and activities involved in the projects. The aim is for this process to serve as a guide for the current team and future employees.

Identification of Monitoring and Control Activities

Based on the project management process, monitoring and control activities were identified. These activities are supported and defined by the theoretical framework presented in these studies, along with the tools and techniques used. It was crucial to clarify the difference between tools and techniques due to common misunderstandings of these terms. In this context, "tools" refer to platforms used (e.g., Excel, Word, Teams), while "techniques" refer to the methods implemented over the required activities.

Standardization of Tools and Techniques

The tools were maintained in their original platforms; however, the techniques were modified and standardized. This addressed the issue of multiple methods being used within the same department for the same topics by different project managers. The standardization was carried out with input from the involved members.

Development and Design of Reports

Reports were developed and designed based on the project manager leader's requirements, aiming to cover topics related to monitoring and control. The automation of documents and presentations is expected to be an effective implementation, reducing the time spent on reports. The original location of the documents was respected, or the location of the main documents in the links was updated.

Implementation Results

The results of the implementation were presented to the project management department and members involved in delivering projects. The alignment over the process, standardization of tools, and ease of generating reports were found to be satisfactory.

7.2 Reliability

The reliability of this study was enhanced by using at least three different data sources: internal documents, interviews and discussions, and observations. Internal documents revealed the current project management processes, monitoring and control status, and reporting practices, including report templates and tools used. Interviews and discussions provided insights gained from internal documents and existing reporting practices within the company. Common meetings with interviewed individuals helped to mutually understand the reporting-related challenges.

The preliminary proposal of this study was validated with the interviewees and finally with the project department manager of the case company. Part of the validation involved questioning the proposed solutions and seeking alternative solutions from existing practices. The validity of the study's outcomes was extensively discussed within the company.

7.3 Research ethics

The study adhered to research ethics, ensuring appropriate citation of all sources to avoid plagiarism. Participants were informed of the study's purpose and their rights to withdraw at any time, with all data collected from surveys and interviews kept confidential. The research upheld the principles of voluntary participation, protecting participants' privacy by securing personal information and removing any identifiable information from the final report. Data collection and analysis were conducted transparently and objectively, and the study reported the results truthfully and accurately.

8 Conclusions and discussions

8.1 Theoretical and practical results integration

The integration of theoretical and practical results has been successfully achieved throughout this study. This is evidenced by the solutions provided to the main questions, which have been applied satisfactorily, supporting the implementation of project management process theories as referenced by Burke, Chemuturi, and Lester. Additionally, guidance on monitoring and control processes, as implemented in this study, has been effectively supported.

Furthermore, Lean and agile methodologies were satisfactorily integrated in 6.1.3, " Implementation of lean and agile methodologies over the project management process". Moreover, the theory presented for report automation in Section 5.3 was implemented in section 6.3.3, "Reports automation", thereby completing the incorporation of all theories presented throughout this study.

8.2 Addressing research questions

- **Research Question 1: How can the company unify the tools and techniques used in project management?**

The analysis of the quantitative data revealed that the most critical challenge was the absence of a detailed project management process. This gap allowed each project manager to interpret, develop, and execute projects using their own chosen methods and techniques.

Researching and identifying the implemented techniques, along with evaluating the effectiveness of each based on the company's vision and methodologies applied to specific activities, will provide clarity on the tools used and the techniques required. By implementing and standardizing processes and providing base formats with clear methodologies and techniques, this issue can be mitigated. It is also recommended to offer comprehensive understanding and training on the processes and techniques to prevent misuse of the formats. The response to the question has been addressed comprehensively.

- **Research Question 2: How can the company improve the time of project reporting?**

The features discussed in Section 5.3 and implemented in Section 6.3 offer the opportunity to reduce the time spent on project reporting. They simplify the process of completing reports and creating presentations through the "integration" feature. Automating data updates will significantly reduce the need to access multiple documents that are systematically used throughout the project's lifecycle. With this explanation, the response to the question has been addressed comprehensively.

8.3 Conclusions

As a result of this study, Biovoima Oy has benefited from the implementation of a new project management process. This process provides clear guidance to the department on the project

lifecycle, outlines the activities to be executed, and details the necessary steps for the maturation of deliverables.

Additionally, the company has seen advantages in the standardized formats (documents and presentations) developed during this study. These formats have helped streamline the monitoring and control activities within the project management department, unifying techniques and simplifying the presentation of reports as part of the monitoring and control processes.

8.3 Suggestions

- During the development of this study, a lack of concordance was identified regarding the understanding of the relationship and connection between departmental activities. It is recommended to develop a workshop to clarify departmental boundaries and explain the role of transversal activities, aiming to enhance communication and delineate responsibilities.

- It is suggested that the project manager leader implement visual boards for daily activities and encourage their use among personnel.

- The company is advised to maintain the integrity of the automation processes by generating a formal work instruction to replicate the implementation in future projects, not limiting it to the current modifications.

- The project manager leader should ensure that the structure of new projects is standardized and aligned with the project management process.

- The project management department should develop standardized formats for the deliverables mentioned in the High-Level Plan that were not included in the scope of this study, with the intention of completing the standardization of documents.

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Appendices

Appendix 1. HLP Check List

BIOVOIMA

FORMATO HIGH LEVEL PLAN (HLP) - CHECK LIST

EDP-F-001	Elaborated 09/04/2024	Versión: 1

EDP

	PROJECT BASIC	PROJECT DEFINITION	EXECUTION OF THE PROJECT	PROJECT CLOSURE
Start-up		DG 1	DG 2	Handover
	FRONT END LOADING			
Goal / Process	Prepare the basis for the detailed definition of the project	Progress project planning to a level where execution can be approved, business case confirmed, and SOR frozen	Deliver an operational asset or product as approved in time, cost and quality	Close project activities (e.g. contractual, documentation, demobilizations, tools) and evaluate their performance
Activities				
Project initiation				
Requirements and Scope	x			
Perform WBS	x			
Team	x			
Learned lessons	x			
Cost	x			
Schedule	x			
Control				
Project Execution Plan - PEP				
Supply	x			
Financial evaluation				
Budget request	N/A			
Engineering				
Construction				
Commissioning				
Quality assurement				
Communications				
Enviroment				
Environmental license	N/A			
Risk management				
HSE Plan				
Materials				
Process Safety				
Performance Metrics				
Deliverables				
Project initiation				
Requirements and Scope				
Perform WBS				
Team				
Learned lessons				
Costs				
Schedules				
Control				
Project Execution Plan - PEP				
Supply				
Financial evaluation				
Budget request				
Engineering				
Construction				
Commissioning				
Quality assurement				
Communications				
Interest groups				
Enviroment				
Environmental license				
Risk management				
HSE Plan				
Materials				
Process Safety				
Performance Metrics				

Appendix 2. HIGH LEVEL PLAN (HLP) Major projects

BIOVOIMA

FORMATO HIGH LEVEL PLAN (HLP) - MAJOR PROJECTS

EDP-F-001	Elaborated 09/04/2024	Versión: 1

EDP

Start-up | DG 1 | DG 2 | Handover

FRONT END LOADING

Goal

Activities

Process	PROJECT BASIC Prepare the basis for the detailed definition of the project	PROJECT DEFINITION Progress project planning to a level where execution can be approved, business case confirmed, and SOR frozen	EXECUTION OF THE PROJECT Deliver an operational asset or product as approved in time, cost and quality	PROJECT CLOSURE Close project activities (e.g. contractual, documentation, demobilizations, tools) and evaluate their performance
Project initiation	Carry out the Charter Project and Formalize it			Perform project closure
Requirements and Scope	Define Scope and Preliminary Requirements	Update Requirements and Scope Close and freeze scope declaration	Freeze and monitor compliance with project scope	
Perform WBS	Perform level 2 WBS according to corporate standard and updated WBS Dictionary	Perform WBS level 3-4 and freeze it according to corporate standard and updated WBS Dictionary		
Team	Form the Project team	Adjust the project team for the definition phase Develop Human Resource Management plan	Complete the project team Conduct training, recruitment and onboarding Start relocation plan for project personnel	Disband the project team
Learned lessons	Identify lessons learned applicable to the project	Incorporate lessons learned and identify new ones	Incorporate lessons learned and identify new ones	Incorporate lessons learned and identify new ones
Cost	Prepare Class 4 cost estimate and the bases of the estimate	Prepare Class 3 or 2 cost estimate and the bases of the estimate and establish cost baseline	Refine the cost estimate Estimate new contract items Estimate cost impacts due to change management	Incorporate project cost information into the organization's databases
Schedule	Develop Schedule Level 1-2	Develop Level 3 Schedule and schedule bases	Develop Level 4 Contractor Schedule, implement and control Estimate impacts in time due to change management	Incorporate project duration information into the organization's databases
Control	Define general project control plan	Detail and freeze project control plan	Implement the project control plan	Closing costs and project schedules
Project Execution Plan - PEP	Plan project execution	Detail project execution plan	Implement the project execution plan	Implement the project closure plan
Supply	Identify general sourcing strategy for the project Review and adjust purchasing, contracting and logistics strategies.	Detail and freeze purchasing, contracting and logistics strategies.	Implement and control the purchasing, contracting and logistics plan. Manage contracts	Closing of contracts, warehouses, inventories. Material balance delivery"
Financial evaluation	Develop preliminary financial assessment	Update financial evaluation	Update financial evaluation	
Budget request	Establish budget and resources for the selection phase	Establish budget and resources required for the execution and closure phases of the project	Request and manage funding resources in accordance with the approval of the investment and business committee.	
Engineering	Develop BAsic engineering Select the value increase practices (VIP's) that apply to the selected concept.	Develop and deliver Basic/Extended Basic Engineering (FEED) Application and results of the PIV's in the project definition process. Report with evidence of incorporation of VIP'S recommendations applied to the project plans Iniciation of Detain engineering	Develop and deliver detailed engineering Implement the results of the application of VIP's in the project definition process Incorporate supplier information into detailed engineering Construction and preparation support	Provide support to operations engineering, if required.
Construction	Support definition of class 5-4 cost estimates and execution times according to defined parameters	Construction plan and specific pre-commissioning for the project	Mechanical completion. Dossier delivery. Earring closure (Type A)	Earring closure (Type B)
Commissioning	Estimation of the project commissioning cost (class 4, according to the defined parameters).	Preparation of the Project Commissioning Plan (updated to Basic Engineering)	Preparation of the Project Commissioning Plan (updated to the Detail Engineer) Commissioning Execution Ease Delivery"	Commissioning Execution Ease Delivery Identification of lessons learned
Quality assurement	Define the quality assurance strategy for the project. Ensure incorporation of quality guidelines. Include quality requirements in the project SOR	Update the quality plan according to the project's purchasing strategy. Verify compliance with quality requirements in the engineering and critical or long delivery stages. -Define Annex Q required for long-term purchases, suppliers and contractors. -Update the quality plan according to the project's purchasing and construction strategy.	Update the quality plan for the execution phase. Ensure compliance with quality requirements in the purchasing, engineering, construction and delivery process. - Update the Quality plan. -Plan and execute contractor audits -Plan and execute Quality reviews. -Plan special Quality verifications. -Ensure proper Management of the MoC. -Ensure compliance of ITPs. -Quality Management of Equipment and Materials	Final project quality status report
Communications	Develop the communications plan	Review the communications plan and start implementation	Implement the communications plan	Close the communications plan
Enviroment	Record the impacts Prepare actors matrix and environment analysis report Analyze the environment Raise environmental and social baseline Evaluate impacts Carry out socio-economic study - socio-economic and cultural baseline Identify environmental requirements	Design of impact management programs Validate social investment plan. Start execution	Monitoring compliance with impact management programs Execute social investment plan"	Close monitoring and perform evaluation against environmental baseline
Environmental license	Identify specific needs for applications for environmental licenses and permits	File an environmental license application (entity applications)	Obtain environmental license/permits	Monitor the closing of commitments with environmental authorities
Risk management	Define the Risk Management Plan for the phase Apply risk management cycle (identification, assessment, treatment, monitoring, communication) Validate and monitor business case risks and asset risks	Update Risk Management Plan for the phase Apply risk management cycle (identification, assessment, treatment, monitoring, communication) Risk monitoring"	Update Risk Management Plan for the phase Apply risk management cycle (identification, assessment, treatment, monitoring, communication)	Update and close risk register
HSE Plan	Define HSE strategy for the project Develop preliminary HSE plan Philosophy	Detail HSE plan Schedules of activities and deliverables	Update HSE plan and execute it with the contractors' specific plans for the project	
Materials		Establish strategy for project materials Define the manufacturing, inspection and delivery times that must be taken into account in the project plan	Ensure logistics and availability of materials for the project	Balance, closure and final disposal of surplus materials.
Process Safety	Define, implement and verify the process security requirements of the project, (as applicable) Perform HSE and ASP verification (as applicable)	Implement and verify the process safety requirements of the project Perform HSE and ASP verification (as applicable)	Implement and verify the process safety requirements of the project Perform HSE and ASP verification (as applicable)	Deliver final status of process safety requirements to the operation
Performance Metrics	Identify project performance metrics	Freeze project performance metrics	Tracking and reporting project performance metrics	

Deliverables

Project initiation	Project Charter (Project Charter) in corporate format signed and uploaded to official repositories			Closing the project in corporate tools
Requirements and Scope	Document preliminary Statement of Requirements (SoR) (Analysis of facilities and locations - Requirements matrix.)	SoR compliance checklist, closed requirements matrix.	Project scope compliance reports	
Perform WBS	WBS level 2 in accordance with corporate standard WBS Dictionary	WBS level 3 - 4 WBS Dictionary updated to definition		
Team	Organizational chart for Characterization and Selection phases approved by Project lead Manager	Adjusted organizational chart for Definition and execution phase approved by project lead Manager	Organizational chart adjusted for execution phase approved by Project lead Manager - Recruitment and training plan implemented - Project team demobilization plan	Project team demobilized
Learned lessons	Report with updated list of lessons learned applicable to the project and action plan	Report with updated list of lessons learned applicable to the project and evidence of their incorporation into the project plans - action plan	Report on lessons learned identified in the execution of the project	Lessons learned report from project closure.
Costs	Report with Class 5-4 Cost estimate for the project and Bases of the cost estimate. (Optimistic P. Most probable P - Pessimistic P)	Report with frozen Class 3 or 2 Cost estimate for the project and Bases of the cost estimate. (P10 - P50 - P90)	Estimation of additional items to those originally contracted for the project. Report with class 2 or 1 cost estimate for project change management.	Updated cost databases based on project cost predictability report.
Schedules	Level I- II Schedule (project cycle) Detailed schedule of the Selection phase Schedule bases"	Probabilistic Level III Schedule - Schedule bases"	Implementation of schedule control plan and progress reporting in corporate Detailed schedule S" curve report	Schedule Predictability Report
Control	"Preliminary Project Control Plan Project Control Report "Characterization phase" "Selection Phase Project Control Report"	Control plan for execution of the updated project. Project Control Report for definition phase	Project control reports.	Project control reports. Cost and time predictability report in corporate tools"
Project Execution Plan – PEP	Project Execution Plan - Preliminary PEP	Project Execution Plan - detailed and definitive PEP	Project Execution Plan - updated PEP and progress report of plans associated with execution	Project Execution Plan - updated PEP and progress report on plans associated with closure
Supply	Specific Supply Plan for the project Detailed supply plan for the next phase (When applicable)	Detailed supply plan for the project Structured priority contractual processes	Progress report on the status of purchases of equipment and materials. Logistics and warehouse management status report.	Liquidation and administrative closure of contracts. Contract closing record in corporate tools
Financial evaluation	Report with the sensitized financial evaluation of the project in accordance with capital discipline guidelines (VEF)	Report with probabilistic financial evaluation of the project in accordance with capital discipline guidelines (VEF)	Report with probabilistic financial evaluation of the project in accordance with capital discipline guidelines (VEF) - (If there is CC) Cost and time forecasting	
Budget request	Detailed budget for the Definition phase	Budget to be requested for the Execution phase (P10 - Base cost - P50 - P90)	Budget to be requested after change control (P10 - Base cost - P50 - P90)	
Engineering	Basic Engineering Master List Plot Plan List of Value Increasing Practices (VIPs) applied	FEED Engineering Master List Updated Plot Plan Report on Value Increasing Practices (VIP's) applied.	Master list of documents reviewed in the field As-Built Plans	Earring closure As-Built Plans
Construction	Estimates of costs and construction execution times	General Construction Plan General Pre-Commissioning Plan	Specific Certification Plan Developed and Executed Specific Commissioning Plan Developed and Executed. AC-1's Received Validation of closure of Type A / Type B earrings. Perform/deliver the HC-1's.	Type B earring closure
Commissioning	Estimated project commissioning cost.	Project Commissioning Plan	Project Commissioning Plan Monitoring and control reports HC1's	Monitoring and control reports HC1's List of lessons learned
Quality assurement	Quality management strategy for projects included in the SOR. Quality requirements" Preliminary Quality Plan for the project. Preliminary Quality Plan for the project.	Quality plan updated according to the progress of the project. Identification of quality requirements to request from suppliers and contractors Updated quality plan document Audit plan Quality Review Implementation Plan Indicators of performance Quality alerts QMS Implementation Index -Annex Q for long lead purchases -Quality plan updated according to the progress of the project.	Updated quality plan for execution including contractors and suppliers Compliance report of QMS elements in the project -Updated quality plan document -Audit plan -Indicators of performance -Quality alerts -Shift management performance review (Moc) -QMS Implementation Index	Project quality issues transferred to operation Measure the Quality Conformity of the project according to the QMS model within the EDP framework. Reports and quality dossier Project PQI measurement
Communications	General communications plan	Communications plan for execution and closure	Communications plan reports	Communications plan reports
Interest groups	Stakeholder Management Plan (Stakeholders and issues of interest identified and prioritized. Stakeholder Matrix)	Relationship and positioning strategy with specific Interest Groups for the execution, transfer to operations and closure of the project	Compliance report on actions associated with: Execution of relationship strategies, compliance with commitments, complaints and claims	Compliance report on actions associated with: Execution of relationship strategies, compliance with commitments, complaints and claims
Enviroment	Environment plan and regulatory compliance Environment Effect investigation	Environment management plan	Progress reports	Progress reports
Environmental license	Report on environmental license and permit requirements Engineering requirements for the initiation of environmental studies	Procedures to obtain the Environmental License	Environmental licenses and permits issued and verified against requests and requirements to execute the project	Report on the status of compliance with environmental commitments
Risk management	Updated Risk Management Plan F2 Project Risk Registry	Updated Risk Management Plan F3 Project Risk Registry	Updated Risk Management Plan F4 Project Risk Registry	Risk Register Risks transferred to the operation
HSE Plan	General HSE plan for the project	HSE plan updated for execution	Contractor HSE plans aligned with the project HSE plan HSE control report	
Materials		Materials and logistics strategy defined	Materials management plan for project execution	Balance and closure of materials Disposition of materials
Process Safety	List of process safety requirements applicable to the project HSE and ASP Verification Report	Deliverables of process safety requirements HSE and ASP Verification Report	Deliverables of process safety requirements HSE and ASP Verification Report	Status of process safety requirements for the operation
Performance Metrics	Performance metrics report	Performance metrics report	Performance metrics report	

Appendix 3. HIGH LEVEL PLAN (HLP) Medium projects

BIOVOIMA

FORMATO HIGH LEVEL PLAN (HLP) - MEDIUM PROJECTS

EDP-F-002	Elaborated 09/04/2024	Versión: 1

EDP

Start-up | DG 1 | DG 2 | Handover

FRONT END LOADING

	PROJECT BASIC	PROJECT DEFINITION	EXECUTION OF THE PROJECT	PROJECT CLOSURE
Goal / Process	**Prepare the basis for the detailed definition of the project**	**Progress project planning to a level where execution can be approved, business case confirmed, and SOR frozen**	**Deliver an operational asset or product as approved in time, cost and quality**	**Close project activities (e.g. contractual, documentation, demobilizations, tools) and evaluate their performance**
Activities				
Project initiation	Carry out the Charter Project and Formalize it			Perform project closure
Requirements and Scope	Define Scope and Preliminary Requirements	Close and freeze scope declaration	Freeze and monitor compliance with project scope	
Perform WBS	Perform level 2 WBS according to corporate standard and updated WBS Dictionary	Perform WBS level 3-4 and freeze it according to corporate standard and updated WBS Dictionary		
Team	Form the Project team	Adjust the project team for the definition phase Develop Human Resource Management plan	Complete the project team Conduct training, recruitment and onboarding Start relocation plan for project personnel	Disband the project team
Learned lessons	Identify lessons learned applicable to the project		Incorporate lessons learned and identify new ones	Incorporate lessons learned and identify new ones
Cost	Prepare Class 4 cost estimate and the bases of the estimate	Prepare Class 3 or 2 cost estimate and the bases of the estimate and establish cost baseline	Refine the cost estimate Estimate new contract items Estimate cost impacts due to change management	Incorporate project cost information into the organization's databases
Schedule	Develop Schedule Level 1-2	Develop Level 3 Schedule and schedule bases	Develop Level 4 Contractor Schedule, implement and control Estimate impacts in time due to change management	Incorporate project duration information into the organization's databases
Control	Adjust/Define Project Control Plan	Detail and freeze project control plan	Implement the project control plan	Closing costs and project schedules
Project Execution Plan - PEP	Plan project execution	Detail project execution plan	Implement the project execution plan	Implement the project closure plan
Supply	Identify general sourcing strategy for the project	Detail and freeze purchasing, contracting and logistics strategies.	Implement and control the purchasing, contracting and logistics plan. Manage contracts	Closing of contracts, warehouses, inventories. Material balance delivery"
Financial evaluation	Develop preliminary financial assessment	Update financial evaluation	Update financial evaluation	
Budget request	Establish budget and resources for the selection phase	Establish budget and resources required for the execution and closure phases of the project	Request and manage funding resources in accordance with the approval of the investment and business committee.	
Engineering	Develop Basic engineering Select the value increase practices (VIP's) that apply to the selected concept.	Develop and deliver Basic/Extended Basic Engineering (FEED) Application and results of the PIV's in the project definition process. Report with evidence of incorporation of VIP'S recommendations applied to the project plans Iniciation of Detail engineering	Develop and deliver detailed engineering Implement the results of the application of VIP's in the project definition process Incorporate supplier information into detailed engineering Construction and preparation support	Provide support to operations engineering, if required.
Construction	Support definition of class 5-4 cost estimates and execution times according to defined parameters	Construction plan and specific pre-commissioning for the project	Mechanical completion. Dossier delivery. Earring closure (Type A)	Earring closure (Type B)
Commissioning	Estimation of the project commissioning cost (class 4, according to the defined parameters).	Preparation of the Project Commissioning Plan (updated to Basic Engineering)	Preparation of the Project Commissioning Plan (updated to the Detail Engineer) Commissioning Execution Ease Delivery"	Commissioning Execution Ease Delivery Identification of lessons learned
Quality assurement	Define the quality assurance strategy for the project. Ensure incorporation of quality guidelines. Include quality requirements in the project SOR	Update the quality plan according to the project's purchasing strategy. Verify compliance with quality requirements in the engineering and critical or long delivery stages. -Define Annex Q required for long-term purchases, suppliers and contractors. -Update the quality plan according to the project's purchasing and construction strategy.	Update the quality plan for the execution phase. Ensure compliance with quality requirements in the purchasing, engineering, construction and delivery process. - Update the Quality plan. -Plan and execute contractor audits -Plan and execute Quality reviews. -Plan special Quality verifications. -Ensure proper Management of the MoC. -Ensure compliance of ITPs. -Quality Management of Equipment and Materials	Final project quality status report
Communications	Develop the communications plan	Review the communications plan and start implementation	Implement the communications plan	Close the communications plan
Enviroment	Record the impacts Prepare actors matrix and environment analysis report Analyze the environment Raise environmental and social baseline Evaluate impacts Carry out socio-economic study - socio-economic and cultural baseline Identify environmental requirements	Design of impact management programs Validate social investment plan. Start execution	Monitoring compliance with impact management programs Execute social investment plan"	
Environmental license		File an environmental license application (entity applications)	Obtain environmental license/permits	
Risk management	Define the Risk Management Plan for the phase Apply risk management cycle (identification, assessment, treatment, monitoring, communication) Validate and monitor business case risks and asset risks	Update Risk Management Plan for the phase Apply risk management cycle (identification, assessment, treatment, monitoring, communication) Risk monitoring"	Update Risk Management Plan for the phase Apply risk management cycle (identification, assessment, treatment, monitoring, communication)	Update and close risk register
HSE Plan	Define HSE strategy for the project Develop preliminary HSE plan Philosophy	Detail HSE plan Schedules of activities and deliverables	Update HSE plan and execute it with the contractors' specific plans for the project	
Materials		Establish strategy for project materials Define the manufacturing, inspection and delivery times that must be taken into account in the project plan	Ensure logistics and availability of materials for the project	Balance, closure and final disposal of surplus materials.
Process Safety	Define, implement and verify the process security requirements of the project, (as applicable) Perform HSE and ASP verification (as applicable)	Implement and verify the process safety requirements of the project Perform HSE and ASP verification (as applicable)	Implement and verify the process safety requirements of the project Perform HSE and ASP verification (as applicable)	Deliver final status of process safety requirements to the operation
Performance Metrics	Update project performance metrics	Freeze project performance metrics	Tracking and reporting project performance metrics	

Deliverables

Project initiation	Project Charter (Project Charter) in corporate format signed and uploaded to official repositories			Closing the project in corporate tools
Requirements and Scope	Document preliminary Statement of Requirements (SoR) (Analysis of facilities and locations - Requirements matrix.)	SoR compliance checklist, closed requirements matrix.		
Perform WBS	Report with updated list of lessons learned applicable to the project and action plan	WBS level 3 - 4 WBS Dictionary updated to definition		
Team	Organizational chart adjusted for Selection phase approved by project lead Manager	Adjusted organizational chart for Definition and execution phase approved by project lead Manager	Organizational chart adjusted for execution phase approved by Project lead Manager - Recruitment and training plan implemented - Project team demobilization plan	Project team demobilized
Learned lessons	Report with updated list of lessons learned applicable to the project and action plan	Report with updated list of lessons learned applicable to the project and evidence of their incorporation into the project plans - action plan	Report on lessons learned identified in the execution of the project	
Costs	Report with Class 5-4 Cost estimate for the project and Bases of the cost estimate. (Optimistic P. Most probable P - Pessimistic P)	Report with frozen Class 3 or 2 Cost estimate for the project and Bases of the cost estimate. (P10 - P50 - P90)	Estimation of additional items to those originally contracted for the project. Report with class 2 or 1 cost estimate for project change management.	Updated cost databases based on project cost predictability report.
Schedules	Level I- II Schedule (project cycle) Detailed schedule of the Selection phase Schedule bases"	Probabilistic Level III Schedule - Schedule bases"		
Control	Updated Project Control Plan Selection Phase Project Control Report"	"Updated Project Control Plan "Selection Phase Project Control Report" "Control plan for execution of the updated project. Project Control Report for definition phase"	Project control reports.	Project control reports. Cost and time predictability report in corporate tools
Project Execution Plan - PEP	Project Execution Plan - Preliminary PEP	Project Execution Plan - detailed and definitive PEP	Project Execution Plan - updated PEP and progress report of plans associated with execution	
Supply	Specific Supply Plan for the project Detailed supply plan for the next phase (When applicable)	Detailed supply plan for the project Structured priority contractual processes	Progress report on the status of purchases of equipment and materials. Logistics and warehouse management status report.	Liquidation and administrative closure of contracts. Contract closing record in corporate tools
Financial evaluation	Report with the sensitized financial evaluation of the project in accordance with capital discipline guidelines (VEF)	Report with probabilistic financial evaluation of the project in accordance with capital discipline guidelines (VEF)	Report with probabilistic financial evaluation of the project in accordance with capital discipline guidelines (VEF) - (If there is CC) Cost and time forecasting	
Budget request	Detailed budget for the Definition phase	Budget to be requested for the Execution phase (P10 - Base cost - P50 - P90)	Budget to be requested after change control (P10 - Base cost - P50 - P90)	
Engineering	Conceptual Engineering Master List Plot Plan List of Value Increasing Practices (VIPs) applied	FEED Engineering Master List Updated Plot Plan Report on Value Increasing Practices (PIV's) applied.	Master list of documents reviewed in the field As-Built Plans	Earring closure As-Built Plans
Construction	Estimates of costs and construction execution times	General Construction Plan General Pre-Commissioning Plan	Specific Certification Plan Developed and Executed Specific Commissioning Plan Developed and Executed. AC-1's Received Validation of closure of Type A / Type B earrings. Perform/deliver the HC-1's.	Type B earring closure
Commissioning	Estimated project commissioning cost.	Project Commissioning Plan	Project Commissioning Plan Monitoring and control reports HC1's	Monitoring and control reports HC1's List of lessons learned
Quality assurement	Quality management strategy for projects included in the SOR. Quality requirements" Preliminary Quality Plan for the project. Preliminary Quality Plan for the project.	Quality plan updated according to the progress of the project. Identification of quality requirements to request from suppliers and contractors Updated quality plan document Audit plan Quality Review Implementation Plan Indicators of performance Quality alerts QMS Implementation Index -Annex Q for long lead purchases -Quality plan updated according to the progress of the project.	Updated quality plan for execution including contractors and suppliers Compliance report of QMS elements in the project -Updated quality plan document -Audit plan -Indicators of performance -Quality alerts -Shift management performance review (Moc) -QMS Implementation Index	Project quality issues transferred to operation Measure the Quality Conformity of the project according to the QMS model within the EDP framework. Reports and quality dossier Project PQI measurement
Communications	General communications plan	Communications plan for execution and closure	Communications plan reports	
Interest groups	Relationship and positioning strategy with specific Interest Groups for the project	Relationship and positioning strategy with specific Interest Groups for the execution, transfer to operations and closure of the project		
Enviroment	Environment Plan	Environment management plan		
Environmental license		Procedures to obtain the Environmental License	Environmental licenses and permits issued and verified against requests and requirements to execute the project	
Risk management	Updated Risk Management Plan F2 Project Risk Registry	Updated Risk Management Plan F3 Project Risk Registry	Updated Risk Management Plan F4 Project Risk Registry	Risk Register Risks transferred to the operation
HSE Plan	HSE plan updated according to selected alternative	HSE plan updated for execution	Contractor HSE plans aligned with the project HSE plan HSE control report	
Materials		Materials and logistics strategy defined	Materials management plan for project execution	Balance and closure of materials Disposition of materials
Process Safety	List of process safety requirements applicable to the project HSE and ASP Verification Report	Deliverables of process safety requirements HSE and ASP Verification Report	Deliverables of process safety requirements HSE and ASP Verification Report	Status of process safety requirements for the operation
Performance Metrics	Performance metrics report	Performance metrics report		

Appendix 4. HIGH LEVEL PLAN (HLP) Small projects

BIOVOIMA

FORMATO HIGH LEVEL PLAN (HLP) - SMALL PROJECTS

EDP-F-003	Elaborated 09/04/2024	Versión: 1

EDP

Start-up | DG 1 | DG 2 | Handover

FRONT END LOADING

	PROJECT BASIC	PROJECT DEFINITION	EXECUTION OF THE PROJECT	PROJECT CLOSURE
Goal / **Descripción**	**Prepare the basis for the detailed definition of the project**	**Progress project planning to a level where execution can be approved, business case confirmed, and SOR frozen**	**Deliver an operational asset or product as approved in time, cost and quality**	**Close project activities (e.g. contractual, documentation, demobilizations, tools) and evaluate their performance**
Activities				
Project initiation	Carry out the Charter Project and Formalize it			Perform project closure
Requirements and Scope	Define Scope and Preliminary Requirements	Close and freeze scope declaration	Freeze and monitor compliance with project scope	
Perform WBS	Perform level 2 WBS according to corporate standard and WBS Dictionary	Perform WBS level 3-4 and freeze it according to corporate standard and updated WBS Dictionary		
Team	Form the Project team	Adjust the project team for the definition phase Develop Human Resource Management plan	Complete the project team Conduct training, recruitment and onboarding Start relocation plan for project personnel	Disband the project team
Learned lessons	Incorporate lessons learned and identify new ones			Incorporate lessons learned and identify new ones
Cost	Prepare Class 4 cost estimate and the bases of the estimate	Prepare Class 3 or 2 cost estimate and the bases of the estimate and establish cost baseline	Refine the cost estimate Estimate new contract items Estimate cost impacts due to change management	Incorporate project cost information into the organization's databases
Schedule	Develop Schedule Level 1-2	Develop Level 3 Schedule and schedule bases	Develop Level 4 Contractor Schedule, implement and control Estimate impacts in time due to change management	Incorporate project duration information into the organization's databases
Control	Adjust/Define Project Control Plan	Detail and freeze project control plan	Implement the project control plan	Closing costs and project schedules
Project Execution Plan - PEP		Detail project execution plan	Implement the project execution plan	Implement the project closure plan
Supply		Detail and freeze purchasing, contracting and logistics strategies.	Implement and control the purchasing, contracting and logistics plan. Manage contracts	Closing of contracts, warehouses, inventories. Material balance delivery"
Financial evaluation	Develop preliminary financial assessment	Update financial evaluation	Update financial evaluation	
Budget request	Establish budget and resources for the selection phase	Establish budget and resources required for the execution and closure phases of the project	Request and manage funding resources in accordance with the approval of the investment and business committee.	
Engineering	Develop Basic engineering Select the value increase practices (VIP's) that apply to the selected concept.	Develop and deliver Basic/Extended Basic Engineering (FEED) Application and results of the PIV's in the project definition process. Report with evidence of incorporation of VIP'S recommendations applied to the project plans Iniciation of Detail engineering	Develop and deliver detailed engineering Implement the results of the application of VIP's in the project definition process Incorporate supplier information into detailed engineering Construction and preparation support	Provide support to operations engineering, if required.
Construction	Support definition of class 4 cost estimates and execution times according to defined parameters	Construction plan and specific pre-commissioning for the project	Mechanical completion. Dossier delivery. Earring closure (Type A)	Earring closure (Type B)
Commissioning	Estimation of the project commissioning cost (class 4, according to the defined parameters).	Preparation of the Project Commissioning Plan (updated to Basic Engineering)	Preparation of the Project Commissioning Plan (updated to the Detail Engineer) Commissioning Execution Ease Delivery"	Commissioning Execution Ease Delivery Identification of lessons learned
Quality assurement	Define the quality assurance strategy for the project. Ensure incorporation of quality guidelines. Include quality requirements in the project SOR	Update the quality plan according to the project's purchasing strategy. Verify compliance with quality requirements in the engineering and critical or long delivery stages. -Define Annex Q required for long-term purchases, suppliers and contractors. -Update the quality plan according to the project's purchasing and construction strategy.	Update the quality plan for the execution phase. Ensure compliance with quality requirements in the purchasing, engineering, construction and delivery process. - Update the Quality plan. -Plan and execute contractor audits -Plan and execute Quality reviews. -Plan special Quality verifications. -Ensure proper Management of the MoC. -Ensure compliance of ITPs. -Quality Management of Equipment and Materials	Final project quality status report
Communications	Adjust/Develop the communications plan	Review the communications plan and start implementation		
Enviroment	Record the impacts Prepare actors matrix and environment analysis report Analyze the environment Raise environmental and social baseline Evaluate impacts Carry out socio-economic study - socio-economic and cultural baseline Identify environmental	Design of impact management programs Validate social investment plan. Start execution	Monitoring compliance with impact management programs Execute social investment plan"	
Environmental license		File an environmental license application (entity applications)	Obtain environmental license/permits	
Risk management		Update Risk Management Plan for the phase Apply risk management cycle (identification, assessment, treatment, monitoring, communication)	Update and close risk register	
HSE Plan	Develop preliminary HSE plan Philosophy	Detail HSE plan Schedules of activities and deliverables	Update HSE plan and execute it with the contractors' specific plans for the project	
Materials		Establish strategy for project materials Define the manufacturing, inspection and delivery times that must be taken into account in the project plan	Ensure logistics and availability of materials for the project	
Process Safety		Implement and verify the process safety requirements of the project Perform HSE and ASP verification (as applicable)	Implement and verify the process safety requirements of the project Perform HSE and ASP verification (as applicable)	Deliver final status of process safety requirements to the operation
Performance Metrics	Identify project performance metrics	Freeze project performance metrics	Tracking and reporting project performance metrics	

Deliverables

Project initiation	Project Charter (Project Charter) in corporate format signed and uploaded to official repositories			Closing the project in corporate tools
Requirements and Scope	Document preliminary Statement of Requirements (SoR) (Analysis of facilities and locations - Requirements matrix.)	SoR compliance checklist, closed requirements matrix.		
Perform WBS	WBS level 2 WBS Dictionary	WBS level 3 - 4 WBS Dictionary updated to definition		
Team	Organizational chart for Characterization and Selection phases approved by Project lead Manager		Organizational chart adjusted for execution phase approved by Project lead Manager - Recruitment and training plan implemented - Project team demobilization plan	Project team demobilized
Learned lessons	Report with updated list of lessons learned applicable to the project and action plan		Report on lessons learned identified in the execution of the project	
Costs	Report with Class 4 Cost estimate for the project and Bases of the cost estimate. (Optimistic P. Most probable P - Pessimistic P)	Report with frozen Class 3 or 2 Cost estimate for the project and Bases of the cost estimate. (P10 - P50 - P90)	Estimation of additional items to those originally contracted for the project. Report with class 2 or 1 cost estimate for project change management.	Updated cost databases based on project cost predictability report.
Schedules	Level I- II Schedule (project cycle) Detailed schedule of the Selection phase Schedule bases"	Probabilistic Level III Schedule - Schedule bases"		
Control	Updated Project Control Plan Selection Phase Project Control Report"	Control plan for execution of the updated project. Project Control Report for definition phase	Project control reports.	Project control reports. Cost and time predictability report in corporate tools
Project Execution Plan - PEP		Project Execution Plan - detailed and definitive PEP	Project Execution Plan - updated PEP and progress report of plans associated with execution	
Supply		Detailed supply plan for the project Structured priority contractual processes	Progress report on the status of purchases of equipment and materials. Logistics and warehouse management status report.	
Financial evaluation	Report with the sensitized financial evaluation of the project in accordance with capital discipline guidelines (VEF)	Report with probabilistic financial evaluation of the project in accordance with capital discipline guidelines (VEF)	Report with probabilistic financial evaluation of the project in accordance with capital discipline guidelines (VEF) - (If there is CC) Cost and time forecasting	
Budget request	Detailed budget for the Definition phase	Budget to be requested for the Execution phase (P10 - Base cost - P50 - P90)	Budget to be requested after change control (P10 - Base cost - P50 - P90)	
Engineering	Conceptual Engineering Master List Plot Plan List of Value Increasing Practices (VIPs) applied	FEED Engineering Master List Updated Plot Plan Report on Value Increasing Practices (PIV's) applied.	Master list of documents reviewed in the field As-Built Plans	Earring closure As-Built Plans
Evaluate alternatives	Alternative selection matrix Selected Alternative Report			
Construction	Estimates of costs and construction execution times	General Construction Plan General Pre-Commissioning Plan	Specific Certification Plan Developed and Executed Specific Commissioning Plan Developed and Executed. AC-1's Received Validation of closure of Type A / Type B earrings. Perform/deliver the HC-1's.	Type B earring closure
Commissioning	Estimated project commissioning cost.	Project Commissioning Plan	Project Commissioning Plan Monitoring and control reports HC1's	Monitoring and control reports HC1's List of lessons learned
Quality assurement	Quality management strategy for projects included in the SOR. Quality requirements" Preliminary Quality Plan for the project. Preliminary Quality Plan for the project.	Quality plan updated according to the progress of the project. Identification of quality requirements to request from suppliers and contractors Updated quality plan document Audit plan Quality Review Implementation Plan Indicators of performance Quality alerts QMS Implementation Index -Annex Q for long lead purchases -Quality plan updated according to the progress of the project.	Updated quality plan for execution including contractors and suppliers Compliance report of QMS elements in the project -Updated quality plan document -Audit plan -Indicators of performance -Quality alerts -Shift management performance review (Moc) -QMS Implementation Index	Project quality issues transferred to operation Measure the Quality Conformity of the project according to the QMS model within the EDP framework. Reports and quality dossier Project PQI measurement
Communications	Updated communications plan	Communications plan for execution and closure		
Interest groups		Relationship and positioning strategy with specific Interest Groups for the execution, transfer to operations and closure of the project		
Enviroment		Environment management plan		
Environmental license		Procedures to obtain the Environmental License	Environmental licenses and permits issued and verified against requests and requirements to execute the project	
Risk management	Updated Risk Management Plan F2 Project Risk Registry	Updated Risk Management Plan F3 Project Risk Registry	Updated Risk Management Plan F4 Project Risk Registry	Risk Register Risks transferred to the operation
HSE Plan	HSE plan updated according to selected alternative	HSE plan updated for execution	Contractor HSE plans aligned with the project HSE plan HSE control report	
Materials		Materials and logistics strategy defined	Materials management plan for project execution	Balance and closure of materials Disposition of materials
Process Safety	List of process safety requirements applicable to the project HSE and ASP Verification Report	Deliverables of process safety requirements HSE and ASP Verification Report	Deliverables of process safety requirements HSE and ASP Verification Report	Status of process safety requirements for the operation
Performance Metrics	Performance metrics report	Performance metrics report		

Appendix 5. FEASIBILITY CHECK LIST

BIOVOIMA	**Feasibility Check List**		
Client's Corporate requirements:			
This section with more up-to-date information, will reinvestigate the clients' corporate requirements to higher level of detail. The clients corporate vision statement relates to long term corporate objectives and the corporate values statement relates to how the company intends to do business. These corporate requirements will set a boundary within, which the project must be implemented and operated.			
Realize benefits	Will the company be able to realise benefits from the project? These are usually expressed as financial but there could be other non-financial types of benefits as expressed by the triple bottom line (profits, planet and people)	YES ☐	NO ☐
Financial Objectives	Will the company make a profit from the operator off the project and achieve the minimum acceptable return on its investment? The business case/project selection criteria might be based on a financial feasibility study quantified as: 1. cash flow statement 2. cost benefit analysis	YES ☐	NO ☐
Positive Cashflow	Could the company cashflow be affected by the project? The company might be experiencing cash flows problems and would, therefore, preferred to only authorise projects with a positive cash flow.	YES ☐	NO ☐
Project Finance	Could the company finances be affected by the project? The company's share price and credit rating will be an impact on the company's ability to borrow and the cost of borrowing. If this adversely impact on the company's ability to borrow, the company will have to use capital rationing and limit the expenditure on projects	YES ☐	NO ☐
Company Resources	Has the company enough resources? The company might want to use only company resources to make the project. If there are no sufficient resources available this might have an impact on the projects build schedule	YES ☐	NO ☐
Corporate budget	Is affecting company budget interest? The progress of the project might be advance or delayed to meet the company's annual budget.	YES ☐	NO ☐
Lifecycle costing	Is lifecycle costing aligning with the company? The company might impose certain lifecycle costing requirements, which look at the long-term cashflow of the projects. This would include maintenance, upgrades and disposals of the project	YES ☐	NO ☐

Diversify Products	Are we implementing new technologies developed by us? Company the company might wish to diversify its products range and entered new markets. The product itself might be to implement industry 4.0 technology transfer for the company to produce the new products. In short term, the project might have to accept subnormal profits to become established.	YES ☐ NO ☐
Buying work	Is the company implementing "buying Work"? During the downturn in the economy, the company's main priority may be to keep the workforce intact. The lower the bid the greater the probability of being awarded the next contract. The lowest a company can bid is to cover the direct cost, with the overheads being writing off. This strategy of lowering the profit margin and writing off the indirect cost is often referred to as "buying work"	YES ☐ NO ☐
Exports	Has been considered? The company might influence the quotation (usually lower) in an effort to acquire exports to enter new markets or take advantage of export incentives.	YES ☐ NO ☐
Partner	Are we requiring a partnership? To reduce the level of risk the company might consider taking on a partner who has previous experience in the field of the project. Taking on a partner to share the risk will also reduce the company's exposure to the project risk.	YES ☐ NO ☐
Industrial relations	Has been evaluated? Industrial unrest is often caused by conflict over pay and working conditions. The project manager might have a little power to influence these negotiations.	YES ☐ NO ☐
Training	Are any trainings being appointed? The project might become the training ground for new recruits, in which case, the company executives should decide if the learning curve is an expense to the project or to the company.	YES ☐ NO ☐
Corporate Schedule	Is the corporate schedule being affected? The projects schedule might be influenced by other company projects or be part of a larger programme. This might influence: 1. Access dates 2. company resource availability 3. complication dates	YES ☐ NO ☐
Approved suppliers	The customer required specific suppliers? The projects procurement supplier might be limited to the company's approval supplier list. This could restrict the project managers ability to obtain the best market price.	YES ☐ NO ☐
Up-Grade	Does the design require an up-grade vision? The executive might require the project to be designed in such a way that they have the option to easily upgrade the project as new technology becomes available.	YES ☐ NO ☐
Benefits and risk	The benefits are overcoming the risks? The benefits vs the risk should be clearly identified. This is usually quantified in the cost benefit analysis unsure align with the acceptable level of risk outlined in the corporate values statement.	YES ☐ NO ☐

Internal Project Constrains		
The internal project constrains relate directly to the scope of the project and ask basic questions about how to make the project.		
Specifications and standards	Are we able to fulfil the specifications and standards? The project must meet certain design specifications, national and international standards.	YES ☐ NO ☐
Level of technology available	Is the level of technology available sufficient to design, implement an operator project? If not, should the project manager recommend project sponsor considers delaying the start of the project	YES ☐ NO ☐
Design freeze	Is the design freeze stablished? At what point in the design development should the project manager impose a design freeze? The project manager needs to strike a balance between incorporating the latest technologies and avoiding the late design changes which can be expensive to incorporate. This will have a greater impact on projects using fast changing technologies.	YES ☐ NO ☐
New technology	If the project has a high component of new technology it needs to be balance it with the acceptable level of project risk outline in the business case corporate values statements.	YES ☐ NO ☐
Resource capability	Can the companies' human resources be trained up to the required level of ability, or should contractors be employed to read the forecast skills requirements? This trade-off is considering the project execution strategy.	YES ☐ NO ☐
Equipment capability	Does the company have the equipment to make the project? If not, is the equipment available? What will be impact the on cost and schedule?	YES ☐ NO ☐ If No, Why:
Built method	Can the company physically make the project? The only way to answer this question is by developing A detailed project build method. The latest 3D modelling suffers enables the project manager to walk through the manufacturing of the project. Identifying who does what, when and how, together with the project support requirements, equipment, material handling, storage, and protection from the elements. This method will soon identify any areas of compromise access on prevent the project becoming a boxed-in.	YES ☐ NO ☐

Transport	Are there any a special transport requirements? There could be a trade-off here between the configuration coma build method and transport, where the build method needs to subdivide the PBS thanks to the largest modules that can be transferred to site. The trade-off being the benefit of the project of large modules, compared with the additional cost of transporting abnormal loads that might require upgrading of roads and bridges.	YES ☐ NO ☐
Material handling	Are any special handling requirements: offloading coma moving and storage?	YES ☐ NO ☐
Management systems	Is the company implementing new managing systems currently? If new management systems are introduced to manage the project, will they be compatible with existing systems they need to interface with? If not, this might lead to double processing	YES ☐ NO ☐
Project office	Is the project office established? Has the project manager been appointed, the projecting selected, the officer space allocated and are the equipment and information systems available? if not, time must be allowed to put these capabilities in place and get them up and running	YES ☐ NO ☐

Internal operations Constraints		
The operation manager is the principal user of the project or facility after is completed and, therefore, will be concerned about how the design and build of the project impacts on the operational configuration, maintenance and upgrading. The project sponsor will also be concerned about the projects operation effectiveness as this is the project sponsors only means of realizing benefits for the company		
Fit for purpose	Is the project covering all the operational needs? The operators' managers first concern will be the business case fitness for purpose. Can the proposal project make the product and offer the facility/service to address the company's operational needs	YES ☐ NO ☐ If No, Why:
Configuration	The configuration of the deliverables must be able to achieve the required performance with existing facilities. The performance might be quantified has producing "x" units per hour.	YES ☐ NO ☐

Environment	Any environment conditions to consideration? The project must be able to operate in a specific environment; this could be under normal weather conditions, or extreme climatic conditions –hot, cold, wet, at sea, on the water.	YES ☐ NO ☐ If No, Which:
Life span	Is life span defined? The project must have a work life off "x" years. For example, coma a power station might have unexpected lifespan of 30 to 50 years.	YES ☐ NO ☐
Start-up disruption	Is any existing operational facility, and if its, is any a star-up visualized already? The operation managers will be concerned with the implementation strategy to ensure minimum start up disruption on the existing operational facility.	YES ☐ NO ☐
Ease of operation	Has been analyse the ease of operation? The operator's manager will be concerned with the users' ease operation of the project because it could have an impact on the operator's skills level and cost of operations.	YES ☐ NO ☐
Operators' level of skill	Does influence the operator's level of skills? The ease of operation of the project or facility will be influenced the operator's level of skill and needs to be related to the company pool of skilled resources. This could go either way; the company might want to specialise in the operation of high-tech equipment or, conversely, the company might want the project to have a very lower ability operator skill requirement.	YES ☐ NO ☐
Operating and maintenance cost	Has been considered the operation and maintenance costs? The operational maintenance cost impacts directly on the bottom line. The concern here is that if the project has been selected because it was the lowest cost to design and build, does it runs the risk of being the most expensive to operate and maintain? This can be addressed by looking at life cycle costing.	YES ☐ NO ☐
Ease of maintenance	Is the projects ease of maintenance has been considered? The operations manager will be preference to ease of access. For example, it will be considered an acceptable to have a dismantling a machine to maintain a minor component.	YES ☐ NO ☐
Maintenance levels of skill	Is the maintenance personal level of skill and registration has been considered? The operator's manager will be preference to facilitate that require a low level of skill and do not require vendor registration.	YES ☐ NO ☐
Maintenance downtime	Is the maintenance downtime has been considered?	YES ☐ NO ☐

Planned maintenance	Does the project require a Planned maintenance plan? In certain industries there is a move towards a planning maintenance programme, where a maintenance scheduled is developed to give the project maximum operation time and minimum downtime. Planning maintenance enables the operations manager to plan ahead and scheduled maintenance when it eats convenient for the company, rather than waiting for a company to fail and have a new schedule breakdown, and then rush to repair it while trying to minimise the disruption cost. The operations manager will cool math therefore, preferred projects with an accurate meantime between failures.	YES ☐ NO ☐
Redundancy	Is required any redundancy for the project? The operators' managers acceptable level of risk might encourage the project designers to include a certain level of redundancy to keep the facility operating even if the components fail. This needs to be balanced with the company's acceptable level of risk has outlined in the corporate values statement. In engineering, the term redundancy means the duplication of a critical component of a system with the intention of increasing reliability of assistance has a backup or fail safe.	YES ☐ NO ☐

External constrains		
External environmental constrains are impose on the project by stakeholders and interested parties outside of the company and, therefore, not part of the project managers direct sphere of influence and control.		
Users and customers	Is it a constrain? The people who buy the project and the people who use or operate the project are the key stakeholders whose opinion and preference should be considered	YES ☐ NO ☐
Regulations	Is it a constrain? National international laws and regulations scanning post constraints on the proposed business case and are usually non-negotiable.	YES ☐ NO ☐
Standards	Is it a constrain? Industry or product related standards can impose constraints on the proposed project.	YES ☐ NO ☐

Local content	Is it a constrain? The product/project might have to be manufactured with a certain level of local content that is predefined by government requirements and might be expressed as a percentage of the value, weight, or labour content. This requirement is used by some countries to protect their local industries.	YES ☐ NO ☐
Climatic conditions	Is it a constrain? Climatic conditions: rain, wind, heat, humidity, extreme cold even El Nino can impact on projects. For example, outdoor constructions projects are typically scheduled to be built during the dry season or summer season.	YES ☐ NO ☐
Special equipment	Is it a constrain? Capital projects might require specialised equipment; their availability and cost will impose an external constraint. For example, heavy lifting equipment for offshore projects might have to be ordered two or three years in advance.	YES ☐ NO ☐
Currency risks	Does represent a risk? Foreign currency fluctuations can impact on the cost of making the project and life cycle costs. The currency risk of the product can be hedged through forward cover, but the long-term currency cost cannot.	YES ☐ NO ☐
Environmental issues	Does represent a risk? Lobby groups coma such as Greenpeace and CND, could have impact on certain types of projects.	YES ☐ NO ☐
Political unrest	Does represent a risk? Political unrest, riots and demonstrations might have a negative impact on the project. This might increase the risk of pursuing projects in political unstable areas.	YES ☐ NO ☐
Local stakeholders	Does represent a risk? Local residents might have an impact on projects on their area. For example, they might try to restrict the use of certain equipment's because of the noise pollution and increase traffic.	YES ☐ NO ☐