



Developing Project Management in an Automotive company

Crafting documentation for standardized processes

Author: Sahil Shah

Master's thesis

December 2023

Master's in Professional Project Management

Shah, Sahil

Developing Project Management in an Automotive company, Crafting documentation for standardized processes

Jyväskylä: Jamk University of Applied Sciences, December 2023, 76 pages.

Master's Degree Programme in Professional Project Management. Master's thesis.

Permission for open access publication: Yes

Language of publication: English

Abstract

Having and enhancing project management guidelines is paramount for any project-based organization. Efficiency of projects can be greatly improved by having concise and clear guidelines, and organized project management documentation. The primary research objective of this study was to identify existing guidelines, processes, and standards related to project management, propose improvisation opportunities, and document them into a handbook.

Multiple focus group discussions and individual interviews were conducted to summarize the existing processes and identify areas for improvement. The existing methodology was benchmarked against international project management standards. A project execution handbook was then crafted based on internal expertise and benchmarking. The handbook is divided into project phases. Every project phase includes a brief description of relevant knowledge areas and best practices. Additionally, All the scattered project-related documentation (standards, guides, templates) was listed with embedded links inside the handbook. Also, a standardized folder structure was created to be used in future projects. A review link of the draft version of the handbook was shared with the whole department for feedback. After carefully analysing and implementing the feedback, a final version was created.

As the organization's processes are dynamic, the handbook serves as a living document. Personnel were trained for adapting the handbook and explained the importance of improvising it while using it. This research work will help the organizations to standardize their processes, document them, have a consistent approach in projects, and all the team members to have clarity of the processes. The work will further help anyone in the project management field to follow the methodology to develop tailor-made guidelines for their project processes.

Keywords/tags (subjects)

Project management, project handbook, challenges, tailored guidelines, best practices, project phases, guidelines, standards, benchmarking, project success, project documentation, standards, project templates, project workflow

Miscellaneous (Confidential information)

Not Applicable.

Contents

1	Introduction	7
1.1	Background and rationale of the development work.....	7
1.2	Motivation for the development work	8
1.3	Current scientific situation related to tailored project management methodology.....	8
1.4	The goal of the development work.....	8
2	Research design	10
2.1	Research Problem	10
2.2	Research Topic	11
2.3	Limitations of the Scope.....	12
2.4	Research Environment	13
2.5	Research methods.....	14
2.5.1	Individual Interviews.....	16
2.5.2	Focus groups	16
2.5.3	Benchmarking	17
2.6	Information Retrieval and Source Material	18
3	Theoretical foundation for the development work	19
3.1	Project Management	19
3.2	Standard Project Management Methodologies	22
3.2.1	International Project Management Association (IPMA)	22
3.2.2	International Organization for Standardization (ISO).....	26
3.2.3	Project Management Institute (PMI).....	29
3.3	Tailored project management framework.....	32
3.4	Project Phases	33
3.4.1	Pre-project activities.....	35
3.4.2	Initiating phase	36
3.4.3	Planning phase.....	37
3.4.4	Execution phase.....	43
3.4.5	Closing phase	46
3.4.6	Post-project activities	47
4	Implementation.....	48
4.1	Individual Interviews	48
4.2	Focus groups	52
4.3	Benchmarking.....	56
4.4	Analysis of data	56

4.5	Ethicality of the study	58
5	Results.....	60
5.1	Project execution handbook	60
5.2	Folder structure for projects	63
5.3	Documentation list.....	65
5.4	Implementation of the results	66
5.5	Further development plan	67
6	Conclusions and Discussion	70
6.1	Reliability of the study	70
6.2	Discussion of the main results	71
6.2.1	Project execution handbook.....	71
6.2.2	Project management documentation list.....	72
6.2.3	Standardized folder structure.....	72
6.2.4	Implementation process development for target department	73
6.3	Conclusions	73
6.4	Further research considerations	75
7	References.....	76

Figures

Figure 1.	Organizations and project management methodology.....	10
Figure 2.	Relation between methodology and project success	11
Figure 3.	Kaizen cycle for continuous improvement	12
Figure 4.	Research methods for the development study	15
Figure 5.	Organization and Projects.....	19
Figure 6.	Project Management in an organizational environment	20
Figure 7.	Key competencies for project management.....	22
Figure 8.	3 areas of PEB model and their interaction	24
Figure 9.	Criteria of model areas.....	25
Figure 10.	Assessment of excellence throughout the project lifecycle	25
Figure 11.	Process groups, interactions, inputs and outputs	26
Figure 12.	Sample organization chart	27
Figure 13.	Integrated project management practices, roles, and relationships	27
Figure 14.	Phases and actions.....	34
Figure 15.	Control over outcome and resource commitments throughout PLC.....	35

Figure 16. Folder structure	64
Figure 17. Training workshop sticky notes	67

Tables

Table 1. KPIs for competence elements of 'Practice'	23
Table 2. Processes according to the phases and knowledge areas	28
Table 3. Processes by phases	31
Table 4. List of Interviews	49
Table 5. List of focus groups.....	53
Table 6. Project execution handbook structure	60
Table 7. Project management documentation list	65

ABBREVIATIONS AND TERMINOLOGY

BS – Body Shop (team of Manufacturing Engineering department)

CAD – Computer Aided Designing software

Commissioner – The party for which development work was carried out

FMEA – Failure Mode and Effects Analysis

HSE – Health, Safety and, Environment department

ICB – Individual Competence Baseline (registered trademark term of IPMA)

IPMA – International Project Management Association

ISO – International Organization for Standardization

JAMK – Jamk University of Applied Sciences (An educational institution in Finland)

Janet – Database service for education and research material

ME – Manufacturing Engineering department

Microsoft Project – Project Management Software

Microsoft Teams – Virtual meeting software

NDA – Non-Disclosure Agreement

OCB – Organizational Competence Baseline (registered trademark term of IPMA)

PDM – Product Data Management software

PEB – Project Excellence Baseline (registered trademark term of IPMA)

PLC – Project LifeCycle

PMBOK – Project Management Body of Knowledge (registered trademark term of IPMA)

PMI – Project Management Institute

PMO – Project Management Office department

PO – Purchase Order

PR – Purchase Requisition

RASI – Responsible, Authority, Support, Inform (Matrix methodology for clarity of responsibilities)

SAP – Software Company

SE – Simultaneous Engineering department

SFS online – Online service of the Finnish Standards Association

SharePoint – Cloud-based storage solution by Microsoft Inc.

TC – Teamcenter (PDM software)

Theseus – Open repository of the University of Applied Sciences in Finland

WBS – Work Breakdown Structure

1 Introduction

1.1 Background and rationale of the development work

Project management is a domain in which a lot of research has been done. There exist ample standards, guidelines, methodologies, and principles about project management. Yet, it is a process that is tailor-made for different businesses, and the approach may even vary between departments even within the same company. The target company of this study has a department called 'Manufacturing Engineering' which has quite distinct needs for project management guidelines and documentation. The experienced experts in the department have a long work history. Projects have been managed, guided, or mentored by them. Even though the approach to managing projects in the past has been methodical, project management guidelines have not been documented. Apart from well-documented guidelines, a clear workflow of the whole project process, checklists and considerations for different phases and functions have been missing.

An essential part of project management guidelines is also well-organized project-related documentation, standards, and templates. The department doesn't have a centralized storage location for all the related documentation. Different storage locations include a common server, SharePoint, and PDM system. This often results in unproductive use of time to either find the documentation or try to work intuitively without success in finding it.

The target department is small and has projects as its core business. Due to this, there are often external resources hired for a fixed term to work on projects. This results in a challenging situation where many new resources are working on the projects. They're not familiar with the department's approach to projects and documentation storage. However, the challenge is not limited to external resources. Often, even the internal personnel find it challenging to find specific guidelines and/or documents.

The importance of an organized folder structure at the beginning of a project is immense. A standardized folder structure for projects is lacking in the target department. This results in additional complexity for the project personnel to organize their documentation in a structured manner which would be easy to find for the concerned parties. The absence of a standardized folder structure also allows for a chaotic arrangement of documents and unnecessary duplicates.

1.2 Motivation for the development work

The development work will greatly improve the complete project management process for the target department. The efficiency, consistency, productivity, and teamwork will be enhanced with the results of this study. It will provide much-needed clarity and bring everyone involved on the same level of understanding for project work. The results of this thesis will prove to be a much-needed kickstart to developing, documenting, utilizing, and maintaining all the guidelines followed by the project teams. The results will also be presented to other departments in the target company which will motivate everyone in the organization to carry out their tasks in a structured manner and improve documentation.

Additionally, the study aims to develop a process which can be used for similar cases in different companies to develop tailor-made guidelines specific to their project management process. As the study focuses on the process itself to develop effective project management guidelines and documentation, it is not limited to a specific sector of the industries. The process can be applied to almost any company/department to achieve similar results.

1.3 Current scientific situation related to tailored project management methodology

Ample of literature exists regarding project management principles and standards in general. Nevertheless, project management is a very broad subject and a tailor-made framework is needed for any department/organization based on specific needs. On the contrary, there exists very little literature when it comes to developing a tailor-made process for project management in specific scenarios. This study will be a significant addition to expanding the knowledge base. It will provide insights into developing tailored project management framework for any entity.

1.4 The goal of the development work

The study aims to standardize the project management process for the target department. The standard workflow of the projects will be identified and documented. A brief description of each knowledge area during different phases will be created. All the best practices, relevant checklists, and links to relevant documentation will be organized according to the phases and functions.

A project execution handbook will be developed for solving the purpose. The handbook will document all the best practices within the department and applicable relevant standards from the literature to further improve the approach during different phases of the project. The handbook will have a brief description of project phases, and functions during those phases. The handbook will help everyone involved in projects to have a clear picture of what is expected from different functions during different phases of the project. The handbook will also have links to all the project-related documentation which will cut down the unproductive time.

Moreover, a standardized empty folder structure will be crafted after identifying the needs of the team. This folder structure will be utilized in future projects from the beginning to organize the documentation clearly. This will further improve the information flow within the project and provide efficiency in finding relevant documents for the team members.

Additionally, a separate list with links to all the documentation (standards, templates, guidelines) will be created. This will make it easier if the sole purpose is to find documents, the links don't need to be plucked from the lengthier project execution handbook.

2 Research design

2.1 Research Problem

Projects are becoming increasingly complex with diversity in stakeholders, evolving technologies, and dispersed knowledge. The need to examine projects from different perspectives and theoretical frameworks arises because of this complexity. (Söderlund, 2011). According to Whitetaker (2014), 42% of organizations didn't have a project management methodology, rest 58% had methodologies with some degree of tailoring. Complete statistics can be seen in Figure 1.

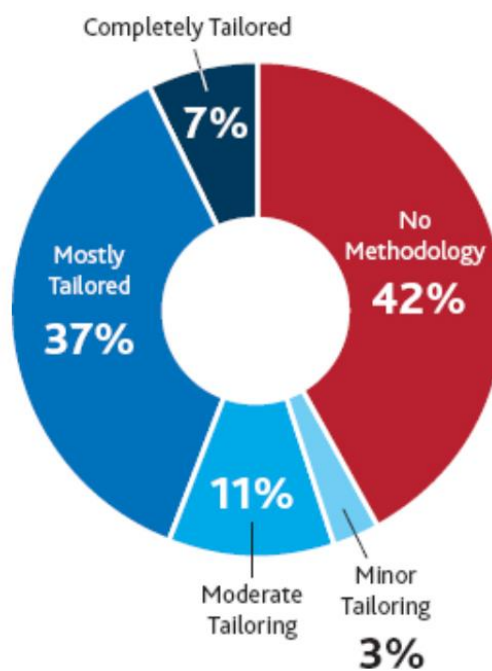


Figure 1. Organizations and project management methodology (Whitetaker, 2014)

A project management methodology includes a clearly outlined, well-documented, and accessible collection of policies, practices, processes, tools, techniques, and templates. This compilation offers guidance on the execution of projects within an organization. Customizing project management methodologies yields varying direct and indirect benefits to organizations. Evidently, the more tailored the methodology, the higher the project success level (see Figure 2). Without a suitably customized project management methodology, individuals will resort to creating their solutions. When the methodology isn't tailored effectively, project personnel execute the projects

without any structure or consistent process. Or they independently alter the methodology without direction, crafting their versions which results in inconsistencies and complexity. (Whitetaker, 2014).

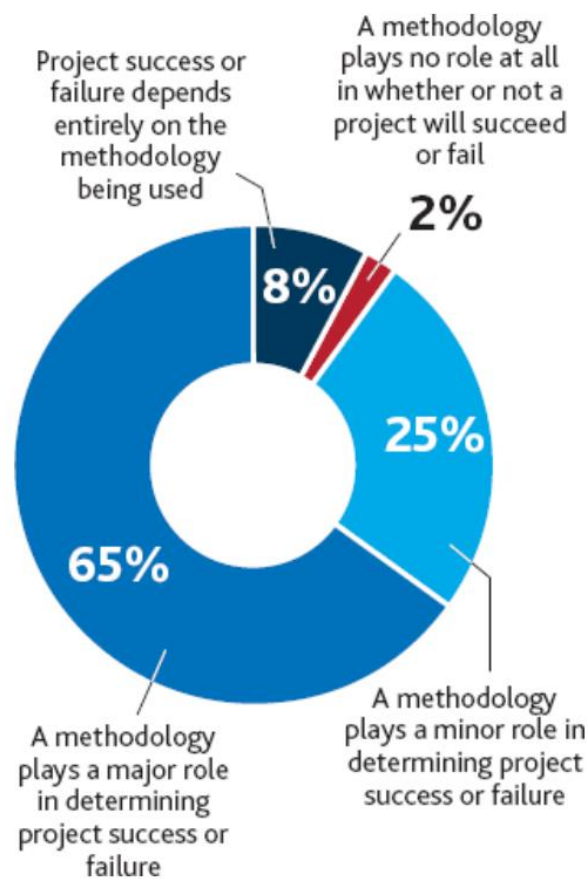


Figure 2. Relation between methodology and project success (Whitetaker, 2014)

As seen, tailormade methodology plays an impactful role in organizations, it was evidently necessary to develop and document it for the target company. This study aims to document and improve the accessibility of all the best practices, templates, standards, and processes for gaining efficiency and consistency in project execution.

2.2 Research Topic

The main theme of the research study is to identify, develop, and document the **Guidelines needed for standardizing the Project Management approach in the Manufacturing Engineering department of an Automotive Contract Manufacturer.**

The primary objective is to gather all the best practices, templates, standards, and processes from internal sources at the target company. Identify and implement additional relevant guidelines from the literature review. And document everything into a clear and concise 'Project Execution Handbook'. This document will serve as an encyclopaedia for the project team members. The handbook will be divided by the project phases and related project functions during those phases.

Other supporting objectives include:

- Making a list of all existing templates, standards, and guidelines with embedded links to the storage location, and owners of the documents (persons or departments).
- Creating a standardized empty folder structure to be used in the kickstarting of future projects.
- Conducting trainings to aware the personnel about the development work and provide motivation and support to follow the developed methodology.

2.3 Limitations of the Scope

In a dynamic era of everchanging organizations, projects, project expectations, and approaches, any developed methodology can't be eternal. So, the developed methodology needs to be constantly adapted to the changing needs. The documentation which is a result of this study will need to go through a constant Kaizen cycle to upkeep the best practices (see Figure 3).

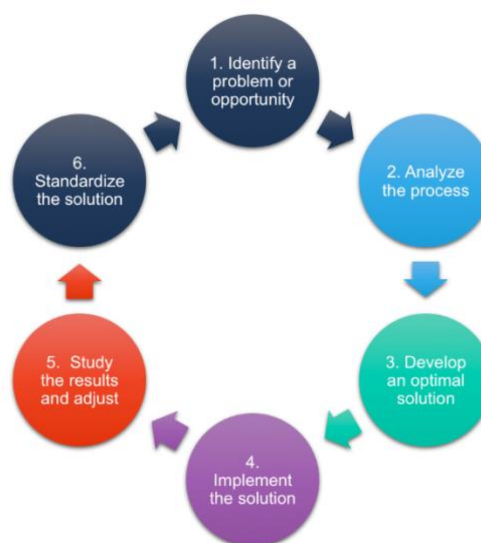


Figure 3. Kaizen cycle for continuous improvement (Do, 2017)

Additionally, every project is unique so, the methodology should be reviewed before every project and tailored as per the demands.

In the current situation, a practical loop (see Figure 4 for reference) of the results wasn't possible due to business-specific reasons. So, the results of the study need to be tested in future projects and adjusted as per requirements if needed. In addition, some templates and technical standards have been missing internally, so those couldn't be documented in the latest version of the handbook and documentation list. For that purpose, a 'List of Open Points' was created to list and track the progress of missing data.

The process and results include some field-specific technical methodologies which might not be applicable in some other sectors of industries. Therefore, if the study is replicated, important technical considerations need to be tailored.

2.4 Research Environment

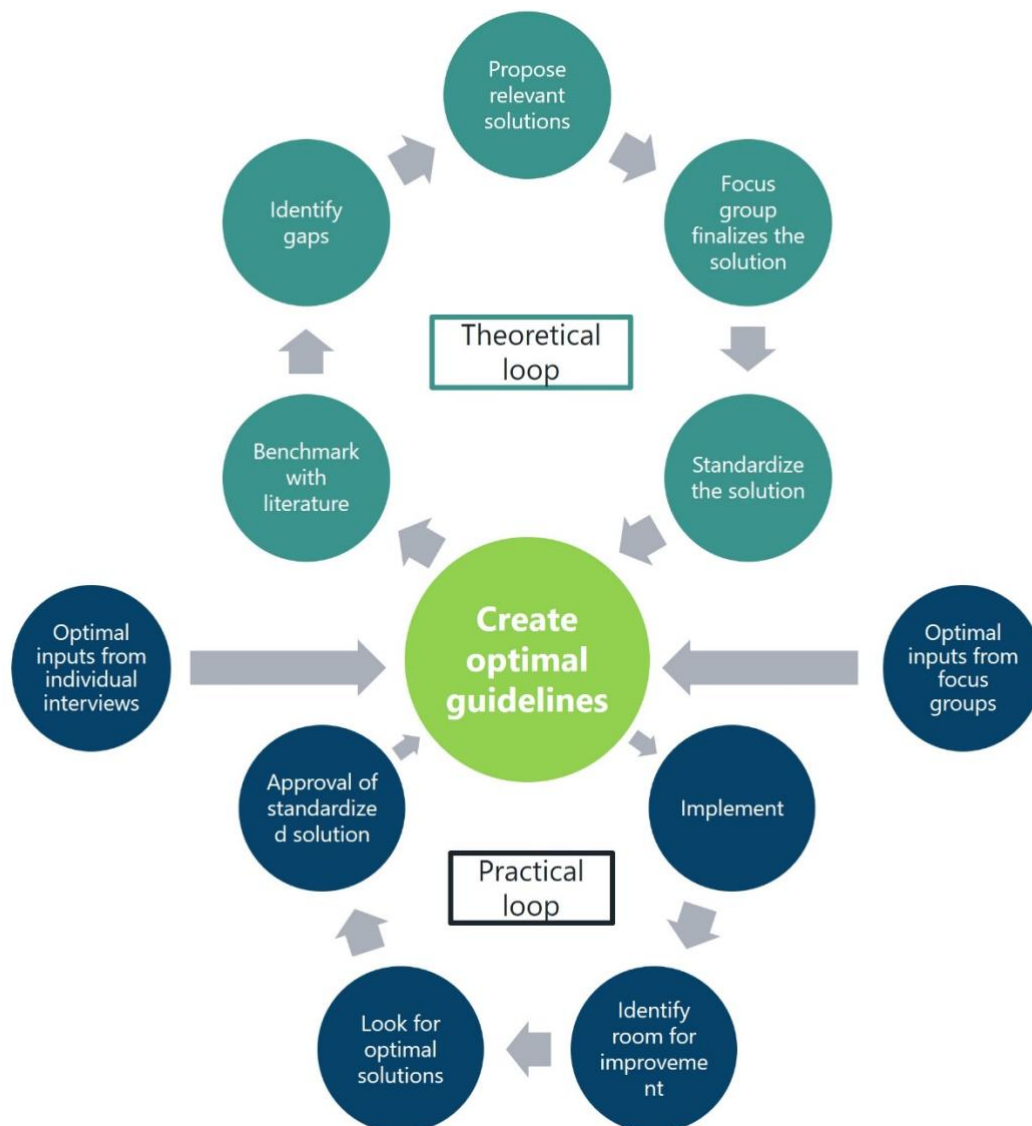
The research is conducted for the Manufacturing Engineering department of a large-scale automotive contract manufacturer. Projects are the core of the target department. The department executes projects from automotive companies to manufacture their vehicles. The production lines are highly automated (using robotic processes) with a usual automation level above 90%. The inputs from the customers are vehicle design CAD models, manufacturing features, material data, assembly sequence, joining information, production volumes, and quality targets. The scope of the projects includes process planning, tooling designing, manufacturing, installation, and commissioning of the production lines. The scope must be achieved within the planned schedule and budget. As the production lines are designed for serial manufacturing, they are extremely dynamic. On average 1 vehicle is produced every 3-5 minutes. So, every micro-step in the planning of these production lines is extremely impactful.

This research study was an internal development project for the target department and thus funded by the department's cost centre. The representative of the commissioning organization has played a huge role in steering the direction of this study to achieve the desired objectives. Weekly status meetings and guidance sessions were held to ensure the direction of the study was aligned with desired outputs. The author of the study is an employee of the target department

which helps to understand the challenges better and is familiar with the organizational culture and internal processes. As a complete project execution handbook is a broad topic and the scope is significantly larger than a single thesis study, some other resources from the department have significantly contributed to achieving the results. The timeline of the project was February-December 2023. The author had 50% of the work time reserved for this development work. All the team members of the target department and supporting functions extended great support to provide the inputs needed for this development work.

2.5 Research methods

An optimal mix of qualitative research methods was chosen to achieve the most advantageous results for the development work (See Figure 4 below for an understanding of the complete



picture).

Figure 4. Research methods for the development study

Considering the nature of the development work, the most suitable research methods were identified. As mentioned previously, a significant number of inputs will be generated from internal existing but undocumented best practices. To gather these inputs and opinions, a qualitative study would provide the optimal and most advantageous results.

For the topics concerning the big picture of the projects, project workflow process, general project-related guidelines, and implementing the previous lessons learnt, the focus group research method was identified to be most suitable. This method brings in inputs from a larger group of experts. This however can be challenging if there were contrasting opinions in some cases. Regardless, the most optimal and suitable approaches for the business were agreed upon.

Additionally, for an in-depth understanding of various technical and managerial functions of the projects, individual interviews with internal subject matter experts were conducted. These sub-functions include Finance, Change Management, Quality, HSE, Direct Sourcing, Indirect Sourcing, Process Planning, Robotics, Automation, Design, PDM, Layouts, Simulation, Virtual Commissioning, Finance, and most importantly Project Management.

A review link of the draft version of the handbook was shared with all the personnel of several departments including the Project Management Office, Simultaneous Engineering, Manufacturing Engineering department's sub-teams: Body Shop, Paint Shop General Assembly, Building Technology, and Supply Chain Management. All the comments were gathered, analysed, and implemented in the first official revision of the handbook.

Although the target department's best practices were generally enough, there is always some room for further improvement. So, it was agreed with the commissioner to review the existing international project management-related standards and guidelines to evaluate them with internal processes and subjectively decide to find relevance and implement them in the results if found beneficial.

2.5.1 Individual Interviews

The complexity of the topic demanded that the interviews with individual subject matter experts more resemble a constructive guided discussion. By providing the cues of the desired result, the discussions were steered in the direction of best practices and inclusion needs for guidelines. The interviewees were given full freedom to include topics which weren't mentioned in the cues. For this manner of data collection, semi-structured interviews were best suited. The set of questions varied based on the sub-functional expertise of the project personnel.

Semi-structured interviews provide flexibility and overcome the fundamental limitation of structured interviews i.e., confinement. Semi-structured interview uses a set of guiding questions to stay focused during the interview but provides creative freedom to explore interesting topics without being confined to a rigid framework. (Wilson, 2016a)

Interviews can yield valuable data when researchers stay receptive to participants' experiences and let the conversation unfold naturally. Although navigating such open-ended discussions can be challenging, they often lead to the discovery of new and unexpected information. Contrastingly, some researchers have faced difficulties when participants provide unexpectedly limited insights or explanations. Reassuring anonymity, asking for a most recent example, and preparing thoughtful follow-up questions can help in such cases. (Dodgson & Trotman, 2022).

2.5.2 Focus groups

Conducting focus groups is a qualitative research method that efficiently gathers a large amount of data from a diverse group of people and ensures efficient use of time. These group discussions explore individuals' perceptions, feelings, or opinions on specific topics. (Wilson, 2016b).

Basically, 6-10 participants are involved in a structured yet adaptable conversation lasting typically 1-2 hours. A moderator guides the discussion and discussion notes are taken. Additionally, it is also recommended to record the session for transcription. The moderator plays a crucial role in shaping the tone of the discussion, aiming for a balance of informality and formality that encourages open communication while also conveying the importance of participants' engagement. (Beck & Manuel, 2008, p. 96)

This research method was chosen for the subjects concerning the complete project workflow, standardized folder structure, and ubiquitous project topics (for example: communication, information flow, lessons learnt, schedule, data storage locations, trainings, and other broad-ranging challenges). This method allows for bringing in a variety of opinions, which is of utmost importance when selecting the best practices. There might be some personal disagreements, but the consensus is followed keeping in mind the best interests of team members and most importantly the business.

2.5.3 Benchmarking

As project management is a complex domain involving many variables and processes, it is challenging to have all the needed guidelines and toolkits perfect at any point in time. They always need to be built upon. Continuously improving project management methodology is essential to enhance operational efficiency, foster innovation, and ensure that organizations can swiftly respond to changing market demands, ultimately driving sustained growth and success. Understanding the significance, benchmarking was chosen as a suitable research method to compare the target department's project management methodology against the applicable relevant international standards. Any identified gaps or relevant improvement opportunities were included in the results of the study after careful considerations with focus groups if found necessary.

Originally, Benchmarking meant using a predefined reference point to compare against. But, in the business realm, the term was adopted as recognized best-in-class achievement that serves as the gold standard for a given business process. (Andersen, 2007, p. 222)

According to Andersen (2007), as mentioned on page 223 of his book, the 4 main benefits of benchmarking are as follows:

- It helps organizations to understand and assess their business processes critically.
- It promotes a learning process by encouraging openness to information sharing, motivating organizational change and improvement.
- Through benchmarking, the organization discovers new ways to improve and alternative approaches beyond its practices.

- It establishes reference points for organizations to measure the performance of their processes.

2.6 Information Retrieval and Source Material

This development study includes gathering, refining, and documenting all the best practices as the primary objective. For this purpose, both primary and secondary sources will be used to enrich the results to their maximum potential. Primary sources include individual interviews and focus groups. Focus groups will bring in the collective wisdom of the team while individual interviews with subject matter experts will be helpful for an in-depth understanding of the needs for the methodology. Focus groups will also be used to create the standardized folder structure for projects. As mentioned previously, the author has been an important part of the target department for approximately 4.5 years, this will bring in additional insights into the nuances of both project processes as well as organizational culture.

For benchmarking, the secondary sources will play a key role in identifying and filling the gaps to enhance project processes. International project management standards like PMI's PMBOK and IMPA's PEB will be used for benchmarking. Additionally, the latest advances in the field will be examined through field-specific journal articles and books. JAMK's Janet service will be used extensively to find all the needed secondary sources.

3 Theoretical foundation for the development work

This section will explore and summarize the current literature in the field of project management. Starting with the basics of project management, then swiftly narrowing it down to the existing project management frameworks, followed by the need for a tailored project management framework, and lastly getting an in-depth understanding of project management framework based on project phases. The project phases section will dive deeper into knowledge areas, considerations, scope, deliverables, documentation, etc. during different phases.

3.1 Project Management

A project can be defined as a temporary initiative pursued to develop a distinct product, service, or outcome (Project Management Institute [PMI], 2017, part 1(1.2.1)). A project can define a broad range of 'group of activities/processes' performed to achieve a specific objective within budget and schedule. For example, this development work can be termed a project. When PMI (2017) terms the project as a temporary endeavour, it implies that a project has a defined start and end. It shouldn't be mistaken as a short-duration activity. The International Project Management Association [IPMA] (2018, p. 34) goes even further and calls the project a temporary organization.

Projects are the drivers of change in an organization. They can also be defined as activities performed to achieve a set of objectives and drive an organization from the 'current state' to a 'future state' (PMI, 2017, part 1(1.2.1)). See Figure 5 below for a visual representation.

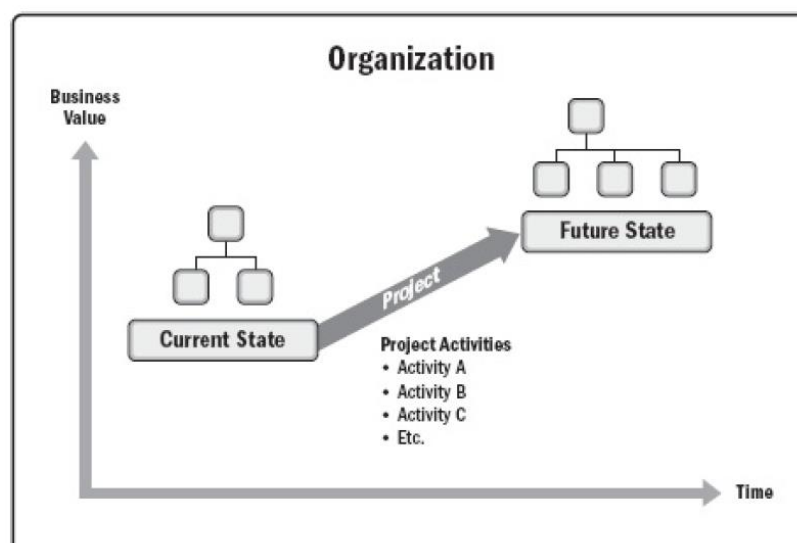


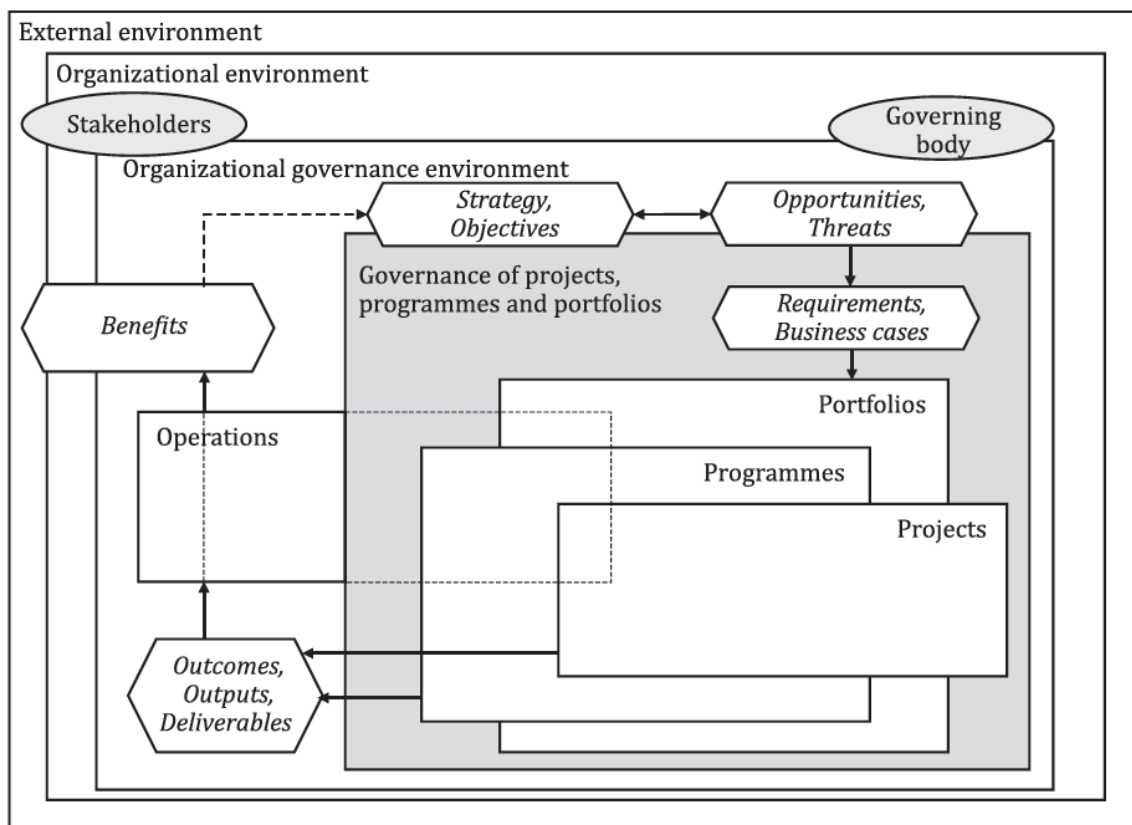
Figure 5. Organization and Projects (PMI, 2017, part 1(1.2.1))

In terms of business, projects define value creation. Value in this context is defined as quantifiable gains. They can be tangible or intangible. Some examples of these quantifiable gains include:

- Market share (tangible)
- Machinery (tangible)
- Stockholder equity (tangible)
- Strategic alignment (intangible)
- Brand reputation (intangible)

(PMI, 2017, part 1 (1.2.1))

According to ISO (2023, p. 13), a project can be organized as a standalone, a part of a programme or, a part of a portfolio. The fundamentals of project management remain the same in every case. The positioning of a project in the big picture of an organization is best depicted in Figure 6 below:



NOTE 1 Opportunities and threats are seen from a strategic perspective.

NOTE 2 The dashed lines of the operations box indicate that operations can stretch into projects, programmes and portfolios (refer to "other related work").

Figure 6. Project Management in an organizational environment (ISO, 2023, p. 9)

“Project management is the application of methods, tools, techniques and competencies to a project.” (International Organization for Standardization [ISO], 2012, p. 4). Achieving effective project management requires the proper application and integration of identified project management processes. Ultimately, project management empowers organizations to execute projects with effectiveness and efficiency. (PMI, 2017, part 1(1.2.2)).

Project Management is becoming extremely important to sustain businesses. According to Wells and Kloppenborg (2015), a few reasons for the importance of project management are:

- Project management makes projects objective.
- It signifies a commitment to both ongoing and upcoming project initiatives.
- It is essential for the strategic planning and seamless execution of communication and coordination across projects.
- It provides clarity of the big picture in projects.
- It establishes a uniform procedure for addressing conflicts systematically.
- It is essential for a functioning business.
- Reliance on assumptions becomes usual without project management.

Additionally, PMI (2017) has mentioned other reasons for the importance of project management in part 1(1.2.2). It helps personnel and organizations to:

- Improve predictability
- Provide deliverables within the agreed time
- Resource optimization
- Systematic change management
- compete more effectively
- Reduces the chances of rework and thus inefficient use of resources

After gaining clarity about what is a project, what is project management, and the importance of project management, in the next section some existing frameworks according to their relevance to the target department will be explored.

3.2 Standard Project Management Methodologies

In this section, various applicable project management frameworks will be explored.

3.2.1 International Project Management Association (IPMA)

IPMA has not made available a single book related to project management, instead, it has divided its standards into various baselines: Individual Competence Baseline (ICB), Project Excellence Baseline (PEB), and Organisational Competence Baseline (OCB). The PEB focuses on how the individual competencies (from ICB) and organizational competencies (from OCB) can be brought together in a project to achieve and assess project excellence.

IPMA (2015) in its ICB has defined the 3 P's of key competencies in project management:

Perspective, People, and practice. Furthermore, these 3 competencies have their specific set of elements (mentioned in Figure 7).

Perspective	People	Practice
<p>The competence area 'perspective' deals with the context of a project.</p> <p>It defines five competence elements:</p> <ul style="list-style-type: none"> • Strategy • Governance, structure and processes • Compliance, standards and regulations • Power and interests • Culture and values 	<p>The competence area 'people' deals with the personal and social competences of the individual.</p> <p>It defines ten competence elements:</p> <ul style="list-style-type: none"> • Self-reflection and self-management • Personal integrity and reliability • Personal communication • Relationships and engagement • Leadership • Teamwork • Conflict and crisis • Resourcefulness • Negotiation • Results orientation 	<p>The competence area 'practice' deals with the core project competences.</p> <p>It defines thirteen competence elements:</p> <ul style="list-style-type: none"> • Project design • Requirements and objectives • Scope • Time • Organisation and information • Quality • Finance • Resources • Procurement • Plan and control • Risk and opportunities • Stakeholder • Change and transformation

Figure 7. Key competencies for project management (adapted from IPMA (2015))

While the 1st and 2nd Ps are equally important, the 3rd P (practice) deserves the main focus for this study to determine the project management methodology. To get an in-depth understanding, key performance indicators (KPIs) for the elements of 'Practice' are mentioned in Table 1 on the next page.

Table 1. KPIs for competence elements of 'Practice' (adapted from IPMA (2015), p.206-210)

KPIs for elements (of the competence 'Practice')	
Competence Element	KPIs
<i>Project Design</i>	<ul style="list-style-type: none"> • Identify and review success criteria • Review lessons learnt from other projects • Examine the complexity and its effect on approaches • Select and review project management methodology • Design the roadmap for project execution
<i>Requirements and Objectives</i>	<ul style="list-style-type: none"> • Strategically organizing the project goals • Determine the requirements of project stakeholders and analyze them • Finalize the requirements and acceptance criteria
<i>Scope</i>	<ul style="list-style-type: none"> • Clearly define the project deliverables • Structure the scope of the project • Create a work breakdown structure • Maintain and establish scope configuration
<i>Time</i>	<ul style="list-style-type: none"> • Define the activities essential to the project • Determine the effort and time needed • Establish a schedule approach • Create the schedule by sequencing activities • Monitor and adjust if necessary
<i>Organization and Information</i>	<ul style="list-style-type: none"> • Determine and assess stakeholder needs for information and documentation • Define the organization chart and clear role descriptions • Define an approach for seamless information flow • Monitor and adjust the organization if necessary
<i>Quality</i>	<ul style="list-style-type: none"> • Development, monitoring, and revising of a quality management plan • Ensure project and deliverables continually meet the requirements of the quality management plan • Verification of quality objectives and recommendation of any corrective/preventive measures if needed • Planning and organizing the validation of project outcomes • Ensuring quality throughout the project
<i>Finance</i>	<ul style="list-style-type: none"> • Determine estimation of project costs • Create a budget • Secure funding for the project • Develop and maintain financial management and reporting • Monitor finances to identify and correct deviations
<i>Resources</i>	<ul style="list-style-type: none"> • Develop a strategic resource plan • Define the quality and quantity of required resources • Identify potential resources and negotiate to acquire them • Optimize resource allocation • Evaluate resource usage and correct it if needed
<i>Procurement</i>	<ul style="list-style-type: none"> • Determine procurement needs and define processes • Contribution to evaluating and supplier selection • Negotiation and agreement on contracts according to project objectives • Supervise contract execution, address issues and redress if necessary

<i>Plan and Control</i>	<ul style="list-style-type: none"> • Project kick-off, develop and seek agreement on the project management plan • Start and manage the transition to the project phase • Ensure project performance meets the requirements of the project plan, and take corrective actions when necessary • Report project progress • Assess and implement project changes with a structured process • Close and evaluate a phase or the project
<i>Risks and Opportunities</i>	<ul style="list-style-type: none"> • Create and execute a risk management framework • Recognize both risks and opportunities • Evaluate the likelihood and consequences of risks and opportunities • Choose strategies and execute response plans for addressing them • Assess and monitor risks, opportunities, and implemented responses
<i>Stakeholders</i>	<ul style="list-style-type: none"> • Recognize stakeholders and assess both their interests and impact. • Establish and uphold a strategy and communication plan for stakeholders • Interact with users, partners, suppliers, and other stakeholders to secure their cooperation and commitment • Organize and maintain networks and alliances
<i>Change and Transformation</i>	<ul style="list-style-type: none"> • Evaluate the organization's flexibility towards change • Recognize the need for change and transformation opportunities • Formulate a change/transformation management strategy • Execute the strategy as planned

The PEB as the name mentions provides a model for organisations to assess their ability and achieve excellence in projects (IPMA, 2018). All the 3 areas are correlated as depicted in Figure 8 below:



Figure 8. 3 areas of PEB model and their interaction (IPMA, 2018, p. 60)

Each of the 3 areas have its criteria which are best illustrated in Figure 9 :



Figure 9. Criteria of model areas (IPMA, 2018, p. 62)

During the complete lifecycle of a project, it is extremely important to ensure and monitor that the objectives for achieving project excellence are met. Figure 10 below represents the significant activities in the pre-project, project, and post-project phases to adhere to the project excellence baseline.



Figure 10. Assessment of excellence throughout the project lifecycle (IPMA, 2018, p. 75)

IPMA ICB and PEB provide criteria to benchmark against in the development work of this study.

3.2.2 International Organization for Standardization (ISO)

Project management is a flow of processes, with each process having defined deliverables. The interactions between the process groups, and inputs and outputs for the processes are depicted in Figure 11. (ISO, 2012).

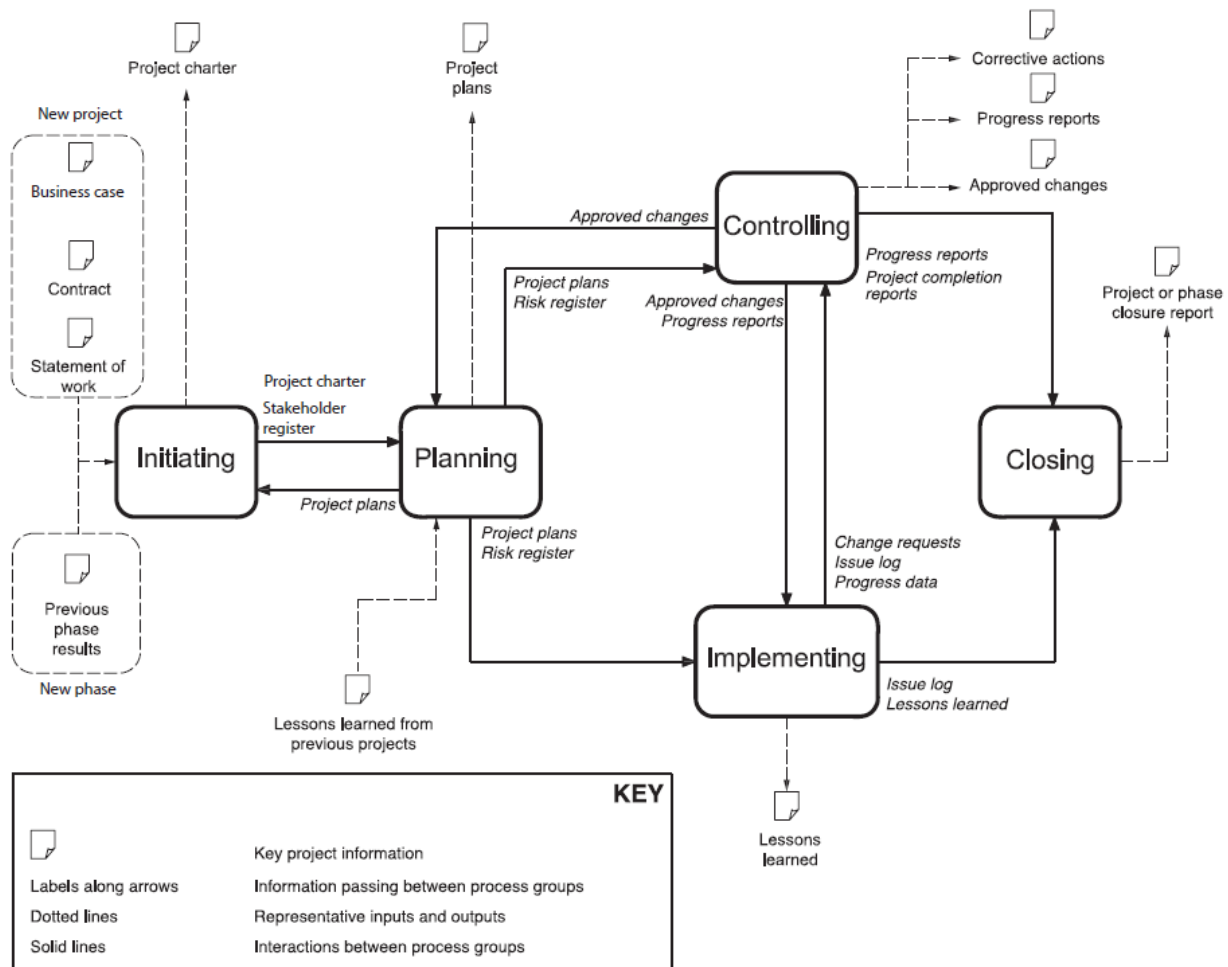


Figure 11. Process groups, interactions, inputs and outputs (ISO, 2012, p. 12)

An organization chart is a very important foundation of any project. It clarifies the responsibilities as well as information flow, and reporting hierarchy. A sample organization chart has been represented in the latest ISO 21502:2021 standard (see Figure 12). This can serve as a baseline for benchmarking in the development work (more on it in the implementation section).

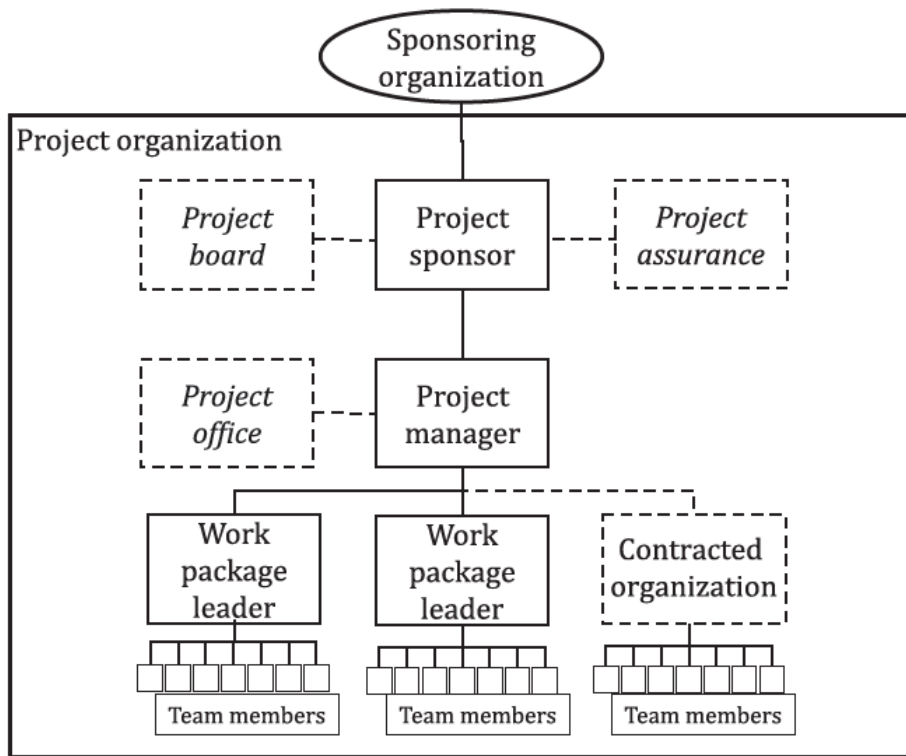


Figure 12. Sample organization chart (ISO, 2021, p. 16)

Furthermore, roles and responsibilities during the entire project lifecycle, as well as the flow of directions, decisions, reporting, advice, and escalations can be seen in Figure 13

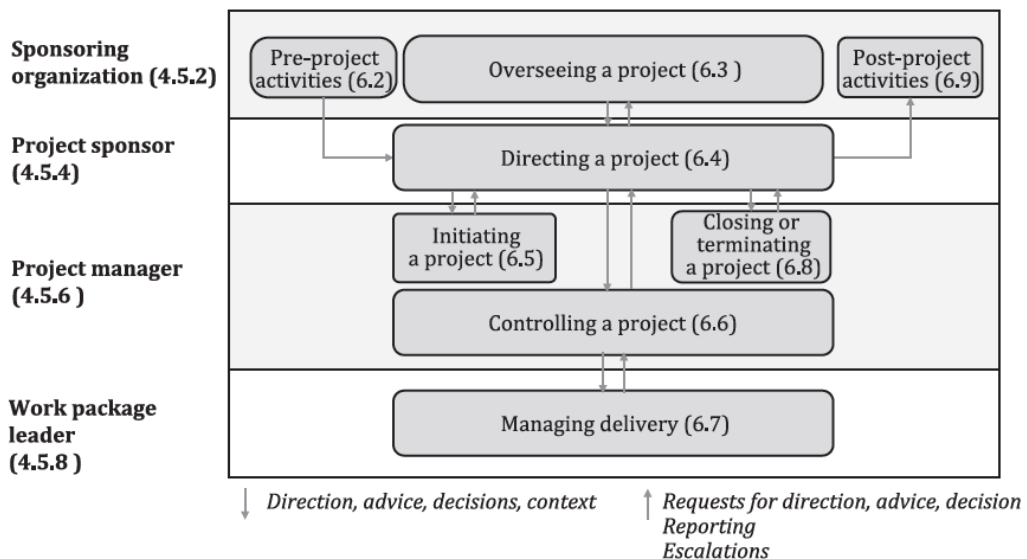


Figure 13. Integrated project management practices, roles, and relationships (ISO, 2021, p. 23)

Note. The numbers mentioned in Figure 13 above reference to sections in the ISO standard and not this document.

A project is a combination of various knowledge areas. All the knowledge areas correspond to certain important activities during different phases of a project lifecycle. These activities have been described and categorized in Table 2 below:

Table 2. Processes according to the phases and knowledge areas (ISO, 2012, p. 10)

Note. The numbers mentioned in Table 2 above reference to sections in the ISO standard and not this document.

Subject groups	Process groups				
	Initiating	Planning	Implementing	Controlling	Closing
Integration	4.3.2 Develop project charter	4.3.3 Develop project plans	4.3.4 Direct project work	4.3.5 Control project work 4.3.6 Control changes	4.3.7 Close project phase or project 4.3.8 Collect lessons learned
Stakeholder	4.3.9 Identify stakeholders		4.3.10 Manage stakeholders		
Scope		4.3.11 Define scope 4.3.12 Create work breakdown structure 4.3.13 Define activities		4.3.14 Control scope	
Resource	4.3.15 Establish project team	4.3.16 Estimate resources 4.3.17 Define project organization	4.3.18 Develop project team	4.3.19 Control resources 4.3.20 Manage project team	
Time		4.3.21 Sequence activities 4.3.22 Estimate activity durations 4.3.23 Develop schedule		4.3.24 Control schedule	
Cost		4.3.25 Estimate costs 4.3.26 Develop budget		4.3.27 Control costs	
Risk		4.3.28 Identify risks 4.3.29 Assess risks	4.3.30 Treat risks	4.3.31 Control risks	
Quality		4.3.32 Plan quality	4.3.33 Perform quality assurance	4.3.34 Perform quality control	
Procurement		4.3.35 Plan procurements	4.3.36 Select suppliers	4.3.37 Administer procurements	
Communication		4.3.38 Plan communications	4.3.39 Distribute information	4.3.40 Manage communications	

NOTE The purpose of this table is not to specify a chronological order for carrying out the activities. Its purpose is to map subject groups and process groups.

3.2.3 Project Management Institute (PMI)

The PMI standards and PMBOK guide discuss every aspect of project management extensively. Summarizing all the guidelines is beyond the scope of the development work. So, the most important and relevant guidelines will be reviewed and discussed in this section.

PMI (2017, part 1(2.3.1)) lists the processes and procedures to be undertaken by an organization for project work:

Initiating and Planning:

- Guidelines for customizing standard processes to meet the project-specific needs
- Organizational standards, including policies such as human resources, HSE, security, confidentiality, quality, and procurement policies
- Life cycles, methods, and procedures for products and projects, including project management methods, estimation metrics, process audits, improvement targets, checklists, and standardized process definitions
- Templates for project management plans, documents, registers, report formats, contract templates, risk categories, risk statement templates, probability and impact definitions, probability and impact matrices, and stakeholder register templates
- Pre-approved supplier lists and various contractual agreements, such as fixed-price, cost-reimbursable, and time and material contracts

Executing, Monitoring & Controlling:

- Procedures for controlling changes, outlining how the organization modifies standards, policies, plans, procedures, or project documents, and the process for approving and validating these changes
- Matrices for traceability
- Procedures for financial controls, encompassing aspects like time reporting, required expenditure and disbursement reviews, accounting codes, and standard contract provisions; Procedures for managing issues and defects, covering controls, identification, resolution, and tracking action items
- Management of resource availability and assignment, along with requirements for organizational communication, including available communication technology, authorized media, record retention policies, videoconferencing, collaborative tools, and security measures

- Processes for prioritizing, approving, and issuing work authorizations
- Templates such as risk registers, issue logs, and change logs
- Standardized guidelines, work instructions, proposal evaluation criteria, and criteria for measuring performance
- Procedures for verifying and validating products, services, or results

Closing:

- Guidelines or requirements for closing a project, such as final project audits, project evaluations, acceptance of deliverables, contract closure, reassignment of resources, and the transfer of knowledge to production and/or operations.

PMI (2023) has grouped 49 processes according to phases as shown in Table 3 on the next page.

Table 3. Processes by phases (PMI, 2023, p. 22)

Project Management Process Groups				
Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
4.1 Develop Project Charter	5.1 Develop Project Management Plan	6.1 Direct and Manage Project Work	7.1 Monitor and Control Project Work	8.1 Close Project or Phase
4.2 Identify Stakeholders	5.2 Plan Scope Management	6.2 Manage Project Knowledge	7.2 Perform Integrated Change Control	
	5.3 Collect Requirements	6.3 Manage Quality	7.3 Validate Scope	
	5.4 Define Scope	6.4 Acquire Resources	7.4 Control Scope	
	5.5 Create WBS	6.5 Develop Team	7.5 Control Schedule	
	5.6 Plan Schedule Management	6.6 Manage Team	7.6 Control Costs	
	5.7 Define Activities	6.7 Manage Communications	7.7 Control Quality	
	5.8 Sequence Activities	6.8 Implement Risk Responses	7.8 Control Resources	
	5.9 Estimate Activity Durations	6.9 Conduct Procurements	7.9 Monitor Communications	
	5.10 Develop Schedule	6.10 Manage Stakeholder Engagement	7.10 Monitor Risks	
	5.11 Plan Cost Management		7.11 Control Procurements	
	5.12 Estimate Costs		7.12 Monitor Stakeholder Engagement	
	5.13 Determine Budget			
	5.14 Plan Quality Management			
	5.15 Plan Resource Management			
	5.16 Estimate Activity Resources			
	5.17 Plan Communications Management			
	5.18 Plan Risk Management			
	5.19 Identify Risks			
	5.20 Perform Qualitative Risk Analysis			
	5.21 Perform Quantitative Risk Analysis			
	5.22 Plan Risk Responses			
	5.23 Plan Procurement Management			
	5.24 Plan Stakeholder Engagement			

3.3 Tailored project management framework

“Tailoring is the deliberate adaptation of approach, governance, and processes to make them more suitable for the given environment and the task(s) at hand.” (Wells & Kloppenborg, 2015, p. 25).

Good practices mentioned in the PMBOK guide and PMI standards should be used as a reference, and it doesn't imply a one-size-fits-all application to every project. (PMI, 2017, part 1(1.2.5)).

Each organization, business case, and project are unique. This research study focuses on developing tailored guidelines for the target department based on experience and relevant standard methodologies. Therefore, even the guidelines developed as a result of this development work, shouldn't be treated as an ultimate methodology to abide by. Flexibility in the approach and mending the guidelines as per the need at the beginning of any project is not only recommended, but even necessary in most cases.

“Sound project management methodologies take into account the unique nature of projects and allow tailoring, to some extent, by the project manager. However, the tailoring that is included in the methodology may still require additional tailoring for a given project.” (PMI, 2017, part 1(1.2.5))

According to PMI (2023, p. 26), the PMBOK guide provides a 4-step tailoring approach:

- Step 1 involves selecting the initial development approach for a project based on factors such as product knowledge, delivery cadence, and available options.
- In Step 2, the project team customizes processes for the organization, acknowledging pre-existing methodologies. Approval may be needed to align with the organization's strategic goals.
- Step 3 focuses on tailoring for the specific project, considering factors like the product, project team, and organizational culture. Questions guide the process of identifying the need for tailoring various aspects.
- Step 4 emphasizes ongoing improvement, viewing tailoring as a continuous process. Throughout progressive elaboration, issues and insights highlight areas where further tailoring can enhance the project. Review points, phase gates, and retrospectives provide opportunities to adapt processes, development approaches, and delivery frequencies.

As mentioned by ISO (2021) on pages 21-22, considerations to be made while tailoring and implementing a project management framework should include:

- Developing an assessment procedure for the framework, with a focus on ensuring its alignment with the organization's strategy, business, and operational goals. This includes evaluating the extent to which lessons are being absorbed and put into practice.
- Assessing the efficiency of the framework and its governance.
- Executing recognized and mutually agreed-upon enhancements based on the evaluation results.
- Identifying and prioritizing improvements and adjustments to be implemented.
- Gathering and applying lessons learned to enhance the outcomes of both current and future projects.
- Enhancing the project management skills of staff by providing education, training, and mentoring opportunities.

The senior management and project office should support the ongoing advancement of project management processes, methods, and techniques, and establish mechanisms for regularly evaluating the maturity of project management within the organization. Effective communication with those impacted by any changes should be ensured, providing clear guidance on how project management is to be conducted within the organization. (ISO, 2021, p. 22).

3.4 Project Phases

A project phase refers to a grouping of logically connected project activities that leads to the achievement of one or more deliverables. The characteristics of life cycle phases can be delineated through various attributes, some of which may be quantifiable and distinctive to a particular phase. The establishment of project phases can be influenced by various factors, such as:

- Management requirements
- Project nature
- Distinctive features of the organization, industry, or technology
- Project elements, encompassing technology, engineering, business, process, or legal aspects
- Decision points, including funding, project go/no-go and milestone reviews

Employing multiple phases offers enhanced insights into project management, allowing for the evaluation of project performance and the implementation of corrective or preventive actions in subsequent phases. An integral element associated with project phases is the phase gate or review. (PMI, 2023, pp. 16-18)

Phase gates/reviews are checkpoints between subsequent phases during which the performance and objectives are assessed, and decisions are made to remain in the phase, continue to the next phase, or end the project. Any corrective actions needed are addressed and plans are calibrated.

Projects have a finite lifecycle. To simplify the complexity, projects are often divided into phases under the umbrella term 'project lifecycle'. A project life cycle encompasses the stages a project undergoes from initiation to conclusion, offering a fundamental structure for project management. This framework remains applicable irrespective of the unique tasks within a project, and the phases may unfold sequentially, iteratively, or concurrently. (PMI, 2017, part 1(1.2.4.1)).

PMBOK and ISO propose generic process groups for dividing the project lifecycle, serving as a framework for detailed project-specific phases. Generic phases and actions during each phase during the project lifecycle (PLC) are defined in Figure 14. (Thamhain & Riedy, 2014, p. 22).

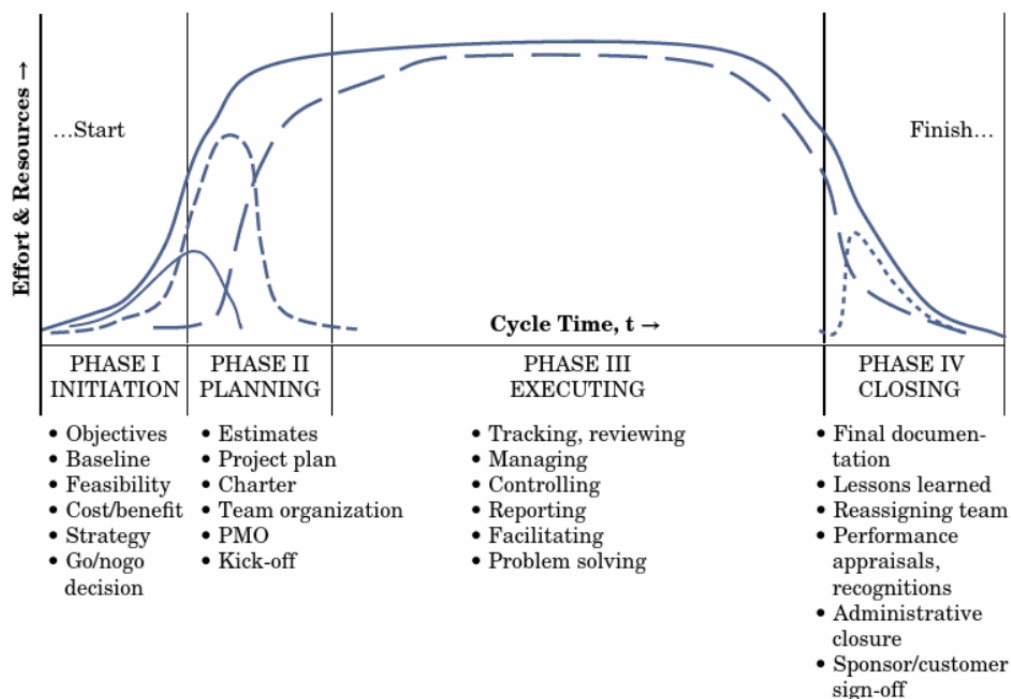


Figure 14. Phases and actions (Thamhain & Riedy, 2014, p. 23)

While the PLC serves as a systematic framework for project planning and control, it is flexible and adaptable. It may not perfectly align with all project activities and contemporary methodologies. Despite this, the PLC remains effective for structuring projects. (Thamhain & Riedy, 2014, p. 22).

The control over outcomes and resource commitments changes as the project progresses. During the early stages, management has greater control over outcomes and can explore various options, but this diminishes as the project progresses and more resources are committed as seen in Figure 15 on the next page. (Thamhain & Riedy, 2014, pp. 22-24).

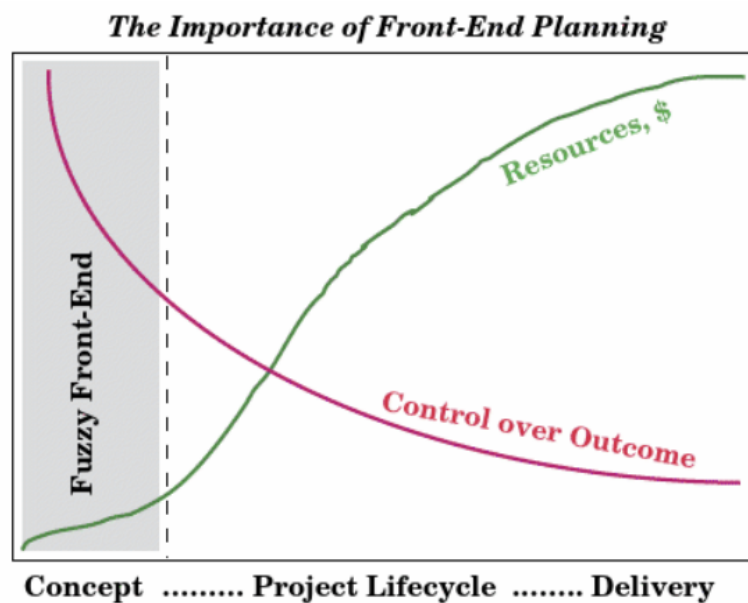


Figure 15. Control over outcome and resource commitments throughout PLC (Thamhain & Riedy, 2014, p. 24)

Along with the generic project phases, ISO (2021) also mentions pre and post-project activities to be a part of the big picture. These will be mentioned in the following sections

3.4.1 Pre-project activities

The goal of the pre-project activities is to ensure that the project is worthwhile to begin. Pre-project activities are those that should be completed prior to deciding to start a project. Identified needs and opportunities resulting from organizational strategy or business requirements should be evaluated to enable senior management, such as organizational management, portfolio management, or program management, to identify potential projects that can transform some or

all these needs and opportunities into realized benefits. These needs and opportunities may meet a new market demand, an existing organizational need, or a new legal necessity.

The project's objectives, benefits, rationale, and investment should be explained and documented in sufficient detail to allow a decision on whether to begin a project to be made. This type of documentation can be utilized to prioritize needs and possibilities. This prioritizing can be related to

- Some components of the organization's strategy or business plan
- Higher-level program or portfolio demands
- The needs of the customer.

The goal of such justification is to gain corporate commitment and authorization for investment in the chosen project, as well as an awareness of the restrictions, risks, and assumptions.

An assessment should be performed to decide whether the project should be done at the organizational, portfolio, or program level. An evaluation of this type should be based on a variety of factors, including quantitative, qualitative, and financial criteria, alignment with corporate strategy, sustainability, and social and environmental effects. Depending on the situation, criteria may differ amongst businesses, portfolios, programs, and initiatives.

Prior to authorizing the project's initiation, the sponsoring organization should:

- Identify the project sponsor and project manager, as well as define their initial responsibilities and authorities
- Define initial governance arrangements
- Determine whether the organization has resources and finances for the entire project, or at least for the first phase, and believes it can secure additional funding for the remainder of the project.

(ISO, 2023, p. 24).

3.4.2 Initiating phase

PMI (2017, part 2(2)) mentions developing a project charter and identifying stakeholders as the main activities. Additionally, ISO (2012, p. 10) lists creating a project team as an important activity during this phase.

Activity 1: Developing a project charter serves the following objectives:

- Formally approving a project or a new project phase.
- Assigning the project manager and specifying their responsibilities and authorities.
- Recording the business requirements, project goals, anticipated deliverables, and economic considerations.

The project charter establishes a connection between the project and the organization's strategic goals and should outline terms of reference, responsibilities, assumptions, and constraints, as applicable. (ISO, 2012, p. 14).

Activity 2: The aim of identifying stakeholders process is to identify the individuals, groups, or organizations that are impacted by or have an impact on the project. It involves documenting pertinent information about their interests and level of involvement. These stakeholders can range from those actively participating in the project to individuals or entities internal or external to the project, and they may hold different levels of authority. (ISO, 2012, p. 17).

Activity 3: The objective of establishing a project team is to secure the human resources essential for project completion. The project manager is responsible for determining how and when project team members will be brought on board, as well as establishing the criteria for their release from the project. In cases where internal resources are insufficient, exploring options such as hiring additional personnel or subcontracting work to external organizations is essential. It is crucial to define the work location, level of commitment, roles and responsibilities, and set up clear reporting and communication protocols.

While the project manager may not always have complete control over team member selection, their involvement in the process is crucial. Factors such as skills, expertise, diverse personalities, and group dynamics should be considered when forming the project team. Given the dynamic nature of projects and their operating environments, this process is typically ongoing throughout the project's duration. (ISO, 2012, p. 19-20).

3.4.3 Planning phase

An extensive list of activities needs to be performed in the planning phase. This phase greatly (not solely) decides the project's success. Better planning ensures fewer roadblocks in the later phases.

In reality, not everything will go according to the plan. That's where the expertise of the project manager and team spirit play a huge role in coping with the changes.

Activity 1: Developing a project management plan is the first crucial step in this phase. It involves defining, preparing, and coordinating all elements of the plan and merging them into a unified 'project management plan' document. The primary advantage of this process is the creation of a thorough document that establishes the foundation for all project activities and outlines how the work will be executed. (PMI, 2023, p. 78).

Activity 2: Scope Management planning is the procedure of formulating a 'scope management plan' document that outlines the procedures for defining, validating, and controlling both project and product scope. The primary advantage of this process is that it furnishes guidance and direction on how scope-related aspects will be overseen and handled throughout the project.

Activity 3: Collect requirements process as the name suggests, is the method of identifying, documenting, and overseeing stakeholder needs and requirements to fulfil project objectives. The principal advantage of this process is that it establishes the groundwork for defining both the product scope and project scope. (PMI, 2023, p. 83).

Activity 4: Defining the scope is the process of creating a comprehensive description of the project and product. The primary advantage of this process is that it articulates the boundaries of the product, service, or result, along with the associated acceptance criteria. Given that not all requirements identified in the Collect Requirements process may be included in the project, the scope definition process involves choosing the final project requirements from the documentation established during activity 3 (collecting requirements). Subsequently, this process develops a detailed description of the project and the associated product, service, or result. (PMI, 2023, p. 85).

Activity 5: Creating a Work Breakdown Structure (WBS) is the process of breaking down project deliverables and work into smaller, more manageable components. The primary advantage of this process is that it establishes a framework that outlines what needs to be delivered in the project. The planned work is encapsulated within the lowest level of WBS components, known as work

packages. Work packages serve as units for grouping activities where work is scheduled, estimated, monitored, and controlled. In the context of the WBS, "work" pertains to the work products or deliverables resulting from activities, rather than the activities themselves. (PMI, 2023, pp. 87-88).

Activity 6: Schedule management planning is the procedure of setting up policies, procedures, and documentation for the planning, development, management, execution, and control of the project schedule. The primary advantage of this process is that it furnishes guidance and direction on how the project schedule will be handled throughout the project. (PMI,2023, p. 89).

Activity 7: Defining activities is the process of identifying and documenting the exact actions to be undertaken to achieve project deliverables. The main advantage of this approach is that it breaks down work packages into scheduled activities that may be used to estimate, schedule, execute, monitor, and control project activity. (PMI,2023, p. 90).

Activity 8: Sequencing activities is the practice of finding and documenting linkages between project activities. The main advantage of this approach is that it defines the logical sequence of activities to achieve maximum efficiency given all project restrictions. Except for the first and last activities, each activity should be linked to at least one predecessor and at least one successor activity via a logical relationship. To build a realistic project timeline, logical relationships should be designed. To ensure a realistic and achievable project timeline, it may be required to use lead or lag time between activities. This process focuses on turning project activities from a list to a graphic as a first step toward publishing the schedule baseline. (PMI,2023, p. 92).

Activity 9: Estimating activity duration encompasses estimating the number of work periods required to perform specific activities given estimated resources. The main advantage of this procedure is that it specifies how long each action will take to finish. The scope of work, skill levels or types of resources that are needed, estimated resource quantities, and resource calendars are all used to estimate the duration of activities. Additional variables that could impact the time estimates include limitations placed on the amount of time, effort, or resource type. (PMI,2023, pp. 94-95).

Activity 10: The process of developing a schedule model for project execution, monitoring, and control involves analysing activity sequences, durations, resource requirements, and schedule constraints. The main advantage of this process is that it creates a schedule model with estimated completion dates for project activities. It is an iterative procedure to create an appropriate project timeline. Based on the best available information, the schedule model is used to determine the projected start and finish dates for project activities and milestones.

To generate an approved project schedule that can serve as a baseline to track progress, schedule creation may necessitate the assessment and updating of duration estimates, resource estimates, and schedule reserves. Defining project goals, identifying and scheduling activities, and predicting durations are all important steps. Once the start and end dates of the activities have been decided, it is typical for the project staff assigned to the activities to review their assigned activities. The staff attests that the start and end dates remain valid because they do not conflict with resource calendars or allocated activities on other projects or tasks. After that, the schedule is examined to see if there are any logical relationship issues and whether resource levelling is necessary before the schedule is accepted and baselined. Throughout the course of the project, the project schedule model will be updated and maintained to provide a realistic timeline. (PMI, 2023, pp. 97-99).

Activity 11: Cost management planning is the process of determining how project costs will be estimated, budgeted for, managed, tracked, and controlled. This process' main advantage is that it offers direction and guidance on how to project expenses will be managed all along the way. It is a component of the project management plan. (PMI, 2023, pp. 99-100).

Activity 12: This activity involves the process of estimating the cost of various resources required to finish a project. The main advantage of this process is that it establishes the amount of monetary resources needed for the project. As more information becomes available and assumptions are tested, cost estimates should be evaluated and adjusted throughout the project to take into account the new information. As the project moves through the project life cycle, the accuracy of the estimate will get better. (PMI, 2023, pp. 100-102).

Activity 13: Determining a budget is the process of combining the projected costs of several tasks or work packages to create an approved cost baseline. This process's main advantage is that it establishes the cost baseline against which project performance can be tracked and managed. All the money approved to carry out the project is included in the project budget. A time-phased project budget that has been authorized and contains management reserves, but not contingency reserves is called a cost baseline. (PMI, 2023, p. 103).

Activity 14: Quality management planning is the process of determining quality standards and/or requirements for the project and its outputs. This procedure outlines how the project will prove that it complies with standards and/or quality requirements. This method's main advantage is that it offers direction and guidance on how quality will be monitored and confirmed throughout the project. (PMI, 2023, p. 102).

Activity 15: Resource management planning is the process of determining how to allocate, obtain, oversee, and make use of human and material. The main advantage of this method is that, depending on the nature and complexity of the project, it determines the approach and degree of management effort required for managing project resources. The purpose of resource planning is to guarantee that there are enough resources available for the project to be completed successfully. Team members, supplies, materials, equipment, services, and facilities are examples of project resources. Planning for scarce resources, or the competition for them is an essential part of effective resource management. (PMI, 2023, pp. 107-109).

Activity 16: Estimating activity resources is the process of predicting the resources required for the project team, as well as determining the types and quantities of materials, equipment, and supplies needed to execute project work. The main advantage of this process is that it identifies the specific type, quantity, and characteristics of resources necessary to successfully complete the project. This activity is closely coordinated with other activities such as cost estimation. (PMI, 2023, pp. 109-110).

Activity 17: Communications management planning is the process of creating a suitable strategy and plan for project communications activities based on the information requirements of each group or stakeholder, the organizational resources that are available, and the project's demands.

The main advantage of this activity is defining a formalized method for quickly and effectively involving stakeholders by providing relevant information. Early in the project life cycle, an efficient communications management plan is created that considers various information needs of the project's stakeholders. It needs to be actively evaluated and adjusted as needed, at the beginning of every new project phase, or as the stakeholder community changes. (PMI, 2023, pp. 111-112).

Activity 18: Risk management planning is the process of outlining how to carry out risk management tasks for a project. The main advantage of this activity is that it guarantees that the scope, nature, and visibility of risk management are proportionate with the risks involved and the project's significance to the company and other stakeholders. This activity should start as soon as a project is conceptualized and should be finished early on. Later in the project life cycle, for instance at a key phase change, if the project scope changes, or if a follow-up assessment of risk management effectiveness indicates the need for modification, it can be required to revisit this process. (PMI, 2023, pp. 113-114).

Activity 19: This activity involves identifying specific project risks as well as the sources of overall project risk and recording their attributes. The documenting of current individual project risks and the causes of total project risk is the main benefit of this activity. Additionally, it compiles data so the project team can react suitably to the identified risks. This is an iterative process because, as a project moves through its life cycle, new specific risks may surface, and the total project risk may also fluctuate. The risk management plan will specify the number of iterations and involvement in each cycle of risk identification, which will differ depending on the circumstances. (PMI, 2023, pp. 115-117).

Activity 20: Qualitative risk analysis is the process of ranking specific project risks for additional study or action by evaluating their likelihood and potential consequences along with other attributes. This activity has the main advantage of concentrating attention on high-priority risks. This activity establishes the relative priorities of various project risks for planning risk responses. For every risk, it designates a risk owner who will be in charge of organizing a suitable risk response and seeing to it that it is carried out. If necessary, this activity provides the foundation for quantitative risk analysis. (PMI, 2023, pp. 117-119).

Activity 21: Quantitative risk analysis assesses the total impact of identified individual project risks and other sources of uncertainty on overall project objectives. This activity measures the total amount of risk associated with the project and can also provide extra quantitative risk data to help with risk response planning. Performing quantitative risk analysis, while not mandatory for all projects, is recommended for large or complex endeavours, strategically important initiatives, or those with contractual obligations or stakeholder requirements. (PMI, 2023, pp. 120-122).

Activity 22: Planning risk responses includes creating options, choosing approaches, and deciding on a course of action to handle both specific project risks and the overall project risk. This activity suggests suitable approaches for handling both specific and overall project risks. In addition to maximizing opportunities and minimizing threats, effective and appropriate risk responses can also lower the overall project risk exposure. (PMI, 2023, pp. 122-124).

Activity 23: Procurement management planning defines the strategy, finds possible vendors, and records project procurement decisions. This activity helps in deciding whether to purchase goods and services from sources outside the project and, if so, the scope, quantity, and schedule. Early in the Plan Procurement Management process, roles and responsibilities pertaining to procurement should be defined. The project manager is responsible for making sure the team is fully staffed with procurement experts at the necessary level. (PMI, 2023, pp. 125-128).

Activity 24: Stakeholder engagement planning is the process of creating strategies to include project stakeholders based on their requirements, expectations, interests, and possible influence on the project. It offers a practical strategy for communicating with stakeholders in an efficient manner. Following the identification of the initial stakeholder community through the Identify Stakeholders process, the first version of the stakeholder engagement plan is prepared. Regular updates are made to the stakeholder engagement plan to consider modifications to the stakeholder community. (PMI, 2023, pp. 129-131).

3.4.4 Execution phase

During the execution phase, all the planning activities are realised, monitored, controlled, and adjusted wherever needed. Efforts and expertise in the planning phase ensure a comparatively smoother execution phase. PMI (2023) has included 'acquiring resources' in the execution phase,

while ISO (2012) has included it in the initiating phase. Depending on the resource pool, it can be beneficial to begin the acquisition already in the initiating phase. If the resources need to be acquired from different teams of the organization, the line manager can plan the allocation of the personnel better if the acquisition is negotiated in advance. If in case, there is a need to hire external resources or sub-contractors, an early indication to HR and the sourcing team will ensure sufficient time to acquire suitable resources. The activities for execution, monitoring and controlling phases are listed below:

Activity 1: Directing and managing project work includes using leadership and team skills to ensure that all the work is executed as planned. Additionally, reviewing project changes and implementing changes: corrective/preventive actions, or defect repairs. (PMI, 2023, pp. 134-136).

Activity 2: Managing project knowledge is the process of applying current knowledge and developing new knowledge to accomplish project goals and support organizational learning. The two main benefits of this activity are that knowledge generated by the project is available to support organizational operations and future projects or phases and that previous organizational knowledge is utilized to produce or improve the project outputs. (PMI, 2023, p. 137).

Activity 3: Managing quality is the process of converting the organization's quality policies into project-specific executable quality activities based on the quality management strategy. This approach has two main advantages: it makes it more likely that the quality targets will be met, and it helps uncover inefficient procedures and low-quality causes. To convey to the stakeholders the project's overall quality state, this activity employs the information and findings from the quality controlling process. (PMI, 2023, p. 140).

Activity 4: Developing a team is different and supplemental to the activity 'establishing a team' in the initiating phase. It is the process of developing team members' interactions, competencies, and general team atmosphere to improve project performance. This approach yields several benefits, the main ones being increased teamwork, higher interpersonal skills and competencies, engaged staff, decreased attrition, and improved project performance overall. (PMI, 2023, p. 145).

Activity 5: Managing the team includes tracking performance, providing feedback, resolving issues, and managing changes within the team to ensure project performance objectives are met. It requires a combination of leadership, management, conflict management, communication, and negotiation skills. (PMI, 2023, p. 150).

Activity 6: Managing communications is making sure project information is created, collected, distributed, stored, retrieved, managed, monitored, and eventually disposed of in a timely and suitable manner. This activity makes it possible for the project team and the stakeholders to communicate effectively and efficiently. It covers every facet of efficient communication, including the selection of suitable tools, strategies, and technologies. Furthermore, it allows adaptability in communications by modifications in the approaches and strategies to suit the evolving requirements of the project's stakeholders. (PMI, 2023, p. 152).

Activity 7: Implementing risk responses is to bring agreed-upon risk response strategies into action. This activity guarantees that predetermined risk responses are carried out according to schedule to reduce overall project risk exposure, minimize specific project risks, and optimize specific project opportunities. (PMI, 2023, p. 154).

Activity 8: Procuring is the process of getting seller responses, choosing a vendor, and making a contract. It helps in choosing a suitable seller and carrying out the delivery arrangement legally. Receiving various quotes, comparing, and making the decision in the best interests of the project is crucial. Agreeing exact scope, schedule, and change management procedures will ensure procurements are aligned with project objectives. (PMI, 2023, p. 156).

Activity 9: Managing stakeholder engagement is the practice of interacting and cooperating with stakeholders to fulfil their requirements and expectations, resolve problems, and promote suitable stakeholder involvement. This activity enables the project manager to reduce stakeholder resistance and maximize support. It can help to make sure that everyone involved is aware of the project's benefits, risks, goals, and objectives as well as how their participation will contribute to its success. (PMI, 2023, pp. 159-160).

Additionally, PMI (2023, p. 161) has listed the following activities for the monitoring and controlling process:

- Monitoring and Controlling Project Work
- Performing Integrated Change Control
- Validating the Scope
- Controlling the Scope
- Controlling the Schedule
- Controlling the Costs
- Controlling the Quality
- Controlling Resources
- Monitoring Communications
- Monitoring Risks
- Controlling Procurements
- Monitoring Stakeholder Engagement

3.4.5 Closing phase

PMI (2023) mentions only one generic closing activity in this phase. 'Collecting lessons learnt' is an additional activity listed by ISO (2012), which is of utmost importance to gather and document the knowledge and experiences of the team. It helps to build knowledge and improve future approaches wherever required.

Activity 1: Formally closing a phase/project is the process of completing all tasks related to a project, phase, or contract. The main advantages of this procedure are the archiving of project or phase information, the completion of scheduled tasks, and the release of organizational team resources to take on new projects. Organizations may have their procedures related to project, phase, or contract closing. The early closure of the project, such as cancelled or abandoned projects, is also encapsulated in this activity. (PMI, 2023, pp. 195-196).

Activity 2: Gathering lessons learnt about the technical, management, and process components of the project are identified by the project team and important stakeholders during the project. Throughout the project lifecycle, the lessons learnt must be recorded, gathered, structured,

preserved, distributed, and applied. As a result, at some point, project management procedures may produce lessons learnt, which could lead to revised project plans. (ISO, 2012, p. 17).

3.4.6 Post-project activities

The post-project activities are meant to confirm that the results are long-lasting and that the anticipated advantages are being attained. The project sponsor should make sure that a review is conducted to ascertain the extent of the project's success, considering factors like:

- Meeting the defined objectives
- Realizing benefits
- Delivering organizational or societal changes or outcomes, like operational performance
- Achieving sustainable changes, like continuing to meet the expectations set in the business case.

Projects under programs or portfolios or those requiring post-closure activities should be especially carefully considered. Benefits and social or organizational improvements might be covered by the project, or they might not. (ISO, 2021, p. 30).

4 Implementation

As discussed in the Research methods, individual interviews, focus groups (group workshops in simple words), and benchmarking were used for this development work. Semi-structured interviews were held with hybrid methods (face-to-face, virtual meetings). Focus group discussions were all held in person to ensure effectiveness and efficiency. Benchmarking was done with the PMI, ISO, and IPMA standards as baseline. The results were then compiled into a project execution handbook. A review link of the document was sent to all relevant teams, feedback was collected, and improvements were made. Training sessions were held with the personnel to discuss the results of the study and its implications. Numerous interviews and focus group discussions were conducted. A few examples will be described in the following sections.

Weekly core team meetings were held to monitor the progress of the development work, discuss the next steps, and adjust wherever needed. The core team included the supervisor of the target department, and other key participants supporting the development work (changed over time depending on the resource availability and allocation).

4.1 Individual Interviews

Participants with expertise in relevant knowledge areas were identified in the core team meetings as per the advice of the commissioner. The topics for Individual interviews were tailored significantly, depending on the expertise of the participants in their respective knowledge areas. Semi-structured interviews gave more freedom to maximize knowledge sharing.

The interviewees were first briefed about the plan and objectives of the development work and a mutually available time slot was agreed for the interviews. Participants were provided with a rough agenda and informed that the interviews would be semi-structured. Participants were assured of anonymity and privacy considerations throughout the process. The interviews lasted an average of 45 minutes. Follow-up interviews were held if the time limit was exceeded and if an extension wasn't possible due to availability. The interviews were conducted between 14.2.2023 and 4.10.2023 as per the needs. Interviews were conducted in a hybrid manner (some virtually and others in person). Meeting notes were taken as audio recordings with participants' consent.

Audio recordings were used to analyse the inputs closely. The list of interviews can be seen in Table 4 below.

Table 4. List of Interviews

Individual interviews list		
Interview	Knowledge area	Agenda Outline
Interview 1	Finance	<ul style="list-style-type: none"> • Finance workflow • Finance status, follow-up, reporting • Various costs and investments to be considered • Budget modification process workflow • Costs and investments templates, their storage locations • Finance sub-folder structure for SharePoint
Interview 2	Health Safety and Environment	<ul style="list-style-type: none"> • HSE planning guidelines and its storage location • Safety plan and its storage location • HSE checklist and its storage location • HSE sub-folder structure for SharePoint • Link to common HSE workspace
Interview 3	Quality	<ul style="list-style-type: none"> • Project quality assurance plan • Quality gates • Quality handbook storage location and accessibility • Project risk assessment guidelines and its storage location • Quality Management process • Scope and objective of Audits • Project risk register template storage location • Process quality report template storage location • Project FMEA, Process FMEA checklists and their storage location • Project FMEA, Process FMEA handbooks and their storage location • Sub-folder structure for SharePoint

Interview 4	PDM system	<ul style="list-style-type: none"> • PDM workflow in a project • Required competences • Collaboration between various technical teams • Clarity of responsibilities • PDM trainings • Customer data handling • Technical documentation handling • Handling of supplier data • Data structure and access rights • Licenses • File formats • Revisioning and change management • Timeline
Interview 5	Designing	<ul style="list-style-type: none"> • Current situation of design guide • Improvement plan • Storage location and accessibility • Design guide main responsible • Preferred components list • CAD formats, versions, and templates • Checklists for different design phases • Checklists for suppliers for different design phases • Timeline
Interview 6	Layout	<ul style="list-style-type: none"> • Layout guidelines • Layout creation software and licenses • File formats for 2D and 3D layouts • Handling of 3D scanning and point cloud formats • Collaboration with design and simulation teams • Timeline • Documentation storage location and approach
Interview 7	Simulation	<ul style="list-style-type: none"> • Simulation stages • Simulation standards current situation • Simulation standards improvement plan • Simulation standards main responsible • Storage location and accessibility • Collaboration scope with other technical phases

		<ul style="list-style-type: none"> • Software and license needs • Checklists for suppliers for different simulation stages • Timeline • Documentation storage location and approach
Interview 8	Robotics	<ul style="list-style-type: none"> • Robotics standards current situation • Robotics standards improvement plan • Robotics standards main responsible • Storage location and accessibility • Timeline • Documentation storage location and approach
Interview 9	Automation	<ul style="list-style-type: none"> • Automation standards current situation • Automation standards improvement plan • Automation standards main responsible • Storage location and accessibility • Preferred components list • Checklist for suppliers
Interview 10	Direct Sourcing	<ul style="list-style-type: none"> • Direct sourcing schedule • Direct sourcing workflow • Direct sourcing scope • Direct sourcing guidelines document and its storage location • RFQ package content • Supplier evaluation and selection • Agreement on deliverables and schedule with the supplier • Supplier follow-up and reporting • Supplier quality standards • Data handling with the supplier • Supplier RASI • Communication plan • NDAs • Sub-folder structure for SharePoint
Interview 11	Indirect sourcing	<ul style="list-style-type: none"> • Indirect sourcing schedule • Indirect sourcing workflow • Indirect sourcing scope • Indirect sourcing guidelines document and its storage location • RFQ package content

		<ul style="list-style-type: none"> • Supplier evaluation and selection • Agreement on deliverables and schedule with the supplier • Supplier follow-up and reporting • Data handling with the supplier • Supplier RASI • Communication plan • NDAs • SAP guidelines and workflow • Supplier kick-off meeting content • Documentation and formalities for external personnel and sub-contractors • Template for supplier change management • Template for sourcing meeting • Sub-folder structure for SharePoint
Interview 12	Change management	<ul style="list-style-type: none"> • Customer data handling • Change requests workflow • Data changes and updates communication • SharePoint sub-folder structure
Interview 13	ICT systems	<ul style="list-style-type: none"> • License planning • Software specifications for licenses • Decision process of Buying vs renting licenses • License cost allocation • License acquisition workflow • License acquisition timeline

Individual interviews provided deeper insight into specific subject areas. These insights were incorporated into the project execution handbook.

4.2 Focus groups

Focus group participants were identified according to the knowledge areas in the core team meetings as per the advice of the commissioner.

The number of participants in each focus group discussion varied between 5-10. The participants were first briefed about the plan and objectives of the development work and a mutually available

time slot was agreed for the focus group discussions. Participants were provided with a rough agenda so they could prepare beforehand. Participants were assured of anonymity and privacy considerations throughout the process. The discussions lasted on average 90 minutes. Follow-up questions were later asked through group chats if the time limit was exceeded and if an extension wasn't possible due to availability. The discussions were conducted between 14.2.2023 - and 4.10.2023 as per the needs. Focus group discussions were primarily held in person, virtual meeting links were provided if some participants weren't available onsite. Meeting notes were taken as audio recordings with participants' consent. Audio recordings were used to analyse the inputs closely. The list of focus group discussions is in Table 5 below:

Table 5. List of focus groups

Focus groups list		
Focus group	Knowledge area	Agenda Outline
Focus group 1	Project Execution Handbook contents and expectations	<ul style="list-style-type: none"> • Scope • Timeline • Structure • Commitment of all members to the development work • Benefits • Risks
Focus group 2	Project workflow and SharePoint Folder structure	<ul style="list-style-type: none"> • Current state analysis • Project workflow • Folder structure and organizing approach • Content • Further proposals
Focus group 3	Project scheduling	<ul style="list-style-type: none"> • Main tasks • Subtasks • Relationships and dependencies • Duration of tasks • Responsible persons • Generic milestones • Quality gates
Focus group 4	Project Plan	<ul style="list-style-type: none"> • Content of the project plan • Project plan skeleton • Lessons learnt from previous projects
Focus group 5	Project closing	<ul style="list-style-type: none"> • Skeleton of a project closing report

		<ul style="list-style-type: none"> • Key Performance Indicators • Collecting, implementing and developing lessons learnt topics
Focus group 6	Project communications	<ul style="list-style-type: none"> • Communication approaches • Meetings, participants, frequencies • Appropriate communication channels • Information flowchart • Handling of sensitive information
Focus group 7	Project lessons learnt	<ul style="list-style-type: none"> • Frequency of lessons learnt discussions • Lessons learnt database • Procedure to propose improvement plans, development project proposals • Ensuring proper implementation • Updated lessons learnt process guidelines
Focus group 8	Documentation list	<ul style="list-style-type: none"> • Existing templates and their storage locations • Missing templates and development plan • Existing standards and guidelines, their storage locations • Missing standards and guidelines, development plan for them • Documentation owners (contact persons) • Naming and revisioning methodology
Focus group 9	Simultaneous Engineering	<ul style="list-style-type: none"> • Scope optimization • Resource sharing • Product data handling • Transition phases • Standardized approaches • Collaboration between Simultaneous Engineering and Manufacturing Engineering departments
Focus group 10	Project Management	<ul style="list-style-type: none"> • Appropriate reporting channels • Reporting hierarchy • Contents of different reports • Lessons learnt • Checklists of deliverables by phases • Project RASI • Role descriptions • Project kick-off checklist • Training matrix

		<ul style="list-style-type: none"> • Time off, remote work, and substitute planning
Focus group 11	Inter-departmental RASI	<ul style="list-style-type: none"> • Responsibilities of different ME departments • Information sharing • Resource sharing • Centralized sourcing • Clarity of grey areas of responsibility boundaries • Standardizing approaches
Focus group 12	RFQ phase	<ul style="list-style-type: none"> • RFQ process workflow • Checklist of required and optional inputs from the customer • Information flow between departments • Pricing library • Involvement of experts • Information handover from RFQ to project • Components of concept calculations • Dealing with assumptions • Checklist of deliverables to the customer
Focus group 13	Benchmarking proposals	<ul style="list-style-type: none"> • Current situation • Missing guidelines and documentation • Discussion of relevant options • Implementation plan
Focus group 14	Project Execution Handbook feedback and improvement areas	<ul style="list-style-type: none"> • Briefing of results • Feedback • Improvement proposals • Implementation plan • Result documentation accessibility and storage location • Further development plan

Focus group discussions provided a broader overview of general topics and strengthened decision-making as a team. Absolute consensus was achieved at the end of the discussions on all the major topics. This information was then incorporated into the project execution handbook to crafting the project management methodology.

4.3 Benchmarking

The preliminary skeleton of the project execution handbook was created based on the benchmarking against various internationally accepted standards (IPMA, PMI, ISO) as a first proposal to the 'focus group 1' discussion. Upon discussions, phases and knowledge areas were tailored to suit the target department. The initiating and planning phases were merged. Monitoring and controlling phases were considered to be a part of the execution phase. Additionally, the RFQ phase was added as it is considered an important beginning phase of the project for the target department. The project closing phase was agreed to be implemented without any modifications. The project execution handbook categorization according to phases and knowledge areas was approved at the beginning of the development work.

The project guidelines followed internally were documented in the draft version of the handbook based on the qualitative data from interviews and focus groups. Benchmarking was done of the documented internal project management methodology against the IPMA, PMI, and ISO standards to find gaps and novel ideas. The potential improvement ideas were then suggested in the core team meetings. Topics that were deemed relevant were included in the 'focus group 13' discussion to seek consensus for implementation in the next versions of the project execution handbook. The ideas implemented are listed in the next section (analysis).

4.4 Analysis of data

Qualitative data collected from the individual interviews and focus groups was analysed very carefully. The inclusion of all the minute details was ensured while still maintaining the focus on the big picture of the development work. The information was already roughly categorized by the design of the agenda for the interviews. Each individual interview corresponded to the knowledge area in the subject group and each focus group discussion had a principal theme. For proper data handling, Schreier (2012, p. 25) suggests to let the categories emerge from the qualitative data. So, the qualitative data collected was further sub-categorized to create the sub-sections in the project execution handbook for a clearer and more concise structure.

From the literature review, the main activities during each project phase throughout the project lifecycle were identified. Additionally, important tools, methods, processes, and documentation

were also reviewed. The draft version of the handbook was analysed and benchmarked against the standards. Some missing documentation and business-specific relevant topics were identified. These ideas were presented and analysed in the 'focus group 13' discussion. Some presented topics were tailored to suit the target department's business needs and others were approved to be implemented without modifications. Qualitative data from this focus group discussion was carefully analysed and sub-categorised to complement the structure of the project execution handbook. The following topics were implemented as a result of the benchmarking study:

- Project execution handbook structure according to phase bifurcation and knowledge areas (implemented with modifications as directed by the focus group 1 discussion).
- The assumptions log was completely missing in the methodology, the idea was approved to be implemented
- Components of the project plan (implemented with modifications as directed by the focus group 4 discussion).
- A project schedule template was decided to be created in Microsoft Project software including detailed tasks, durations, and inter-dependencies in the 'focus group 3' discussion. (Previously, only an Excel sheet was used with no clarity on inter-dependencies)
- Acquiring resources timeline modification (As mentioned in ISO (2012), resource acquisition was implemented as a guideline to be carried out in the initiating phase).
- Checklists for deliverables for some phases and knowledge areas were missing (An implementation plan was proposed to the target department)
- Role descriptions were vague and unclear (Clear role descriptions were made in the 'focus group 10' discussion and implemented in the project execution handbook)
- Clear workflows didn't exist for some phases and knowledge areas (Based on interviews and focus groups, these were created and included in the project execution handbook)
- A communication plan was completely missing from the methodology (Guidelines for a communication plan were included in the project execution handbook after the focus group discussion)
- Documentation was scattered and not easily accessible (A proposal of a documentation list made to the focus group was approved, and implemented as a result of this thesis)
- Change logs template didn't exist (Target department was advised to include this in future development plan)

- Stakeholders' involvement wasn't considered in some key discussions (Clear mention of key stakeholders' involvement in different discussions has been implemented in the project execution handbook)

4.5 Ethicality of the study

Offering the participants, the opportunity to have their identities hidden in a research report is the cornerstone of ethical research. Anonymity promotes objectivity in the research process by dissemination of research. (Oliver, 2010, pp. 77-78). The data needs to be decoupled from the participants for fair analysis. In this development work, all the participants involved in interviews and focus groups were assured of anonymity and privacy throughout the process. The names of personnel, organizations, and projects were removed from the research report.

Participation in a study should be voluntary for ethical research. All the participants involved in this development work were given the option to opt-out. But, as the study is a development study and will have benefits for the target department, all the participants were more than willing to participate.

Confidentiality is another very important research ethic. Organizations have the right to not let business-sensitive information be compromised. By assuring confidentiality, the representatives of an organization would be more willing to share important data comparatively openly (Oliver, 2010, p. 89). For the study, project and customer names were eliminated from the report. Even the name of the commissioner has not been revealed in the study.

Furthermore, the storage of data should be considered in research ethics. The main challenge in storing research data lies in the potential for its use in future research or unauthorized access by non-researchers. Despite the initial researcher's compliance with privacy regulations, there is no assurance that future users will do the same. Therefore, it is crucial for those collecting and storing data to carefully consider its potential uses. Anonymizing individuals effectively is a key element in any storage procedure to minimize adverse effects on respondents if the data is used for other purposes. Typically, it is unnecessary to retain all raw data once a study is documented in a thesis or journal article. In qualitative studies, anonymized extracts are commonly used to support arguments. (Oliver, 2010, p. 90). The audio recordings were stored on the commissioning

company's servers. The files were named to be only recognizable by the researcher. After the study, the recordings were deleted, and participants were informed about it.

Lastly, All the literature sources used for the study are correctly cited and referenced according to APA (7th edition) guidelines to discourage and prevent plagiarism. Only primary literature sources were used for the study. The literature was obtained legally through licensed services: Janet, Theseus and, SFS Online. Data collection and analysis for this study were completely transparent and objective. The results reported are truthful and accurate.

5 Results

As a result of all the qualitative data collected from interviews, focus groups, and benchmarking, the project management framework documents were crafted for the target department. Additionally, a standardized folder structure was created to be implemented in future projects of the target department. A list of all relevant project documentation (templates, standards, guidelines), links to their storage location, and document owners was created. For the target department to realize the full benefits of the development work, personnel were trained to implement the created project management framework in their work. Each result is discussed in detail in the following sections.

5.1 Project execution handbook

The project execution handbook was categorised into 4 project phases: RFQ phase, Project Planning phase, Project Execution phase and, Project Closing phase. The phases were further bifurcated into identified knowledge areas. Each topic in the handbook includes a brief description, workflow, best practices, and links to relevant documentation. The structure of the project execution handbook can be seen in Table 6 below:

Table 6. Project execution handbook structure

1 Introduction
2 Abbreviations and definitions
2.1 Abbreviations
2.2 Terminology
3 RfQ phase
3.1 Workflow of RFI / RFQ phase
3.2 Project schedule skeleton
3.3 Concept calculations
3.3.1 Strategic meeting
3.3.2 Resource estimate
3.3.3 Project costs
3.3.4 Investments
3.3.5 Blue-collar resources
3.3.6 Estimation of license needs
3.4 ME and SE Collaboration
3.5 Inter-departmental RASI

3.6 Checklist of deliverables**3.7 RfQ handover to project team****4 Project planning****4.1 Key elements of the project planning phase****4.2 Project plan****4.3 Resource planning****4.3.1 Training matrix****4.3.2 Responsibility Matrix and Role Description****4.3.2.1 Role descriptions****4.3.3 Organization chart****4.3.4 License planning****4.4 Communication plan****4.4.1 Information flow in projects****4.5 Budget and Investments****4.6 Project time schedule****5 Project execution****5.1 Project kick-off meeting****5.1.1 Checklist for kick-off meeting****5.2 Lessons Learnt workshop from previous projects****5.3 Sharepoint Folder structure****5.3.1 Templates & standards****5.4 Resource management****5.4.1 Organization chart follow-up****5.4.1.1 New resource onboarding****5.4.1.1.1 New resources at the beginning of the project****5.4.1.1.2 Resource swap amidst a project****5.4.2 Remote work, Time off and substitute planning****5.4.3 Team meetings and workshops****5.4.4 Trainings****5.4.4.1 Skills matrix****5.4.5 RASI chart follow-up****5.4.6 NDA****5.5 Finance****5.5.1 Investments and Costs****5.5.2 Workflow of project finance****5.5.3 Status and Follow-up****5.5.4 Reporting****5.6 Timeline follow-up****5.7 Data storage****5.7.1 Access rights****5.7.2 Product data****5.7.3 Tooling CAD data**

- 5.7.3.1 Formats**
- 5.7.3.2 Templates**
- 5.7.3.3 Guides**
- 5.7.3.4 Managing revisions**

5.7.4 Other documentation

5.8 Sourcing

5.8.1 Indirect sourcing

- 5.8.1.1 Time schedule**
- 5.8.1.2 Indirect Sourcing Handbook**
- 5.8.1.3 Process of purchasing investment items**
- 5.8.1.4 Process of Purchasing Cost**
- 5.8.1.5 RfQ process & workflow**
 - 5.8.1.5.1 NDA (depending on the case)**
 - 5.8.1.5.2 RfQ package technical content**
- 5.8.1.6 SAP process for PRs, POs**
- 5.8.1.7 Sourcing meeting and supplier selection**
- 5.8.1.8 Kick-off meeting with supplier**
 - 5.8.1.8.1 Data package for supplier**
 - 5.8.1.8.2 Confirmation of software version and standards**
 - 5.8.1.8.3 External RASI**
 - 5.8.1.8.4 Communication plan**
- 5.8.1.9 Supplier follow-up and reporting**
 - 5.8.1.9.1 Supplier change management**
- 5.8.1.10 Other supplier-related issues**
 - 5.8.1.10.1 On-site resource documentation**
 - 5.8.1.10.2 Safety trainings for suppliers (site safety)**
 - 5.8.1.10.3 Contractor documentation**
 - 5.8.1.10.4 Accommodation & rental car for on-site resources**

5.8.2 Outsourcing, direct sourcing and supplier quality

- 5.8.2.1 Definition**
- 5.8.2.2 Outsourcing Process Timeline**

5.9 Project execution technical phases

5.9.1 Process concept phase

5.9.2 Engineering phase

- 5.9.2.1 Templates, standards, and documents for the Engineering phase**
- 5.9.2.2 Design**
 - 5.9.2.2.1 Concept**
 - 5.9.2.2.2 3D Finish**
 - 5.9.2.2.3 Final Delivery**
- 5.9.2.3 Manufacturing**
- 5.9.2.4 Installation and commissioning**
- 5.9.2.5 Pre-production phases**

- 5.9.2.5.1 Try-outs
- 5.9.2.5.2 Pre-series
- 5.9.2.6 Layout
 - 5.9.2.6.1 3D Layout
 - 5.9.2.6.2 2D Layout
- 5.9.2.7 Simulation
- 5.9.2.8 Robotics
- 5.9.2.9 Automation
- 5.10 Quality
 - 5.10.1 Project Quality Assurance
 - 5.10.2 Project Risk Assessment
 - 5.10.3 Audits
 - 5.10.3.1 Process audits
 - 5.10.3.2 Product audits
 - 5.10.4 Quality management
 - 5.10.4.1.1 Project Risk Assessment
- 5.11 HSE
 - 5.11.1 HSE Planning
 - 5.11.1.1 Safety Plan
- 5.12 Change management
 - 5.12.1 Scope change management
 - 5.12.2 Change management function
- 5.13 Project status follow-up and reporting
 - 5.13.1 Area-wise status
 - 5.13.2 SFM and onsite status
 - 5.13.3 Try-outs and pre-series status
- 6 Project closing
 - 6.1 Final documentation checklist
 - 6.2 Project report
 - 6.3 Lessons learnt
 - 6.3.1 Project closing phase lessons Learned concept

The review link of the draft version of the handbook was shared with all relevant departments. The link allowed the participants to add comments to specific text inside the handbook. All the comments were presented in a focus group, analysed, and implemented in the following revisions.

5.2 Folder structure for projects

Well-structured and logically organized project-specific documentation is the key to efficient information sharing within the project team. It can have multiple benefits such as reduced unproductive time by improved accessibility, transparency in documentation, reduced clutter,

prevention of duplicate documents, findability of latest versions of the documents, etc. To reap the advantages of the standardized folder structure, the project team must commit to a structured way of working. This was ensured by providing trainings and convincing by explaining the advantages (more in section 5.4).

The main level of the folder structure was categorized according to the categories identified in focus group discussions. Sub-levels were identified from the individual interviews with knowledge-area experts. The draft structure was proposed in further focus group discussions and finalized with modifications. The main level and some examples of sub-levels are shown in Figure 16 below:

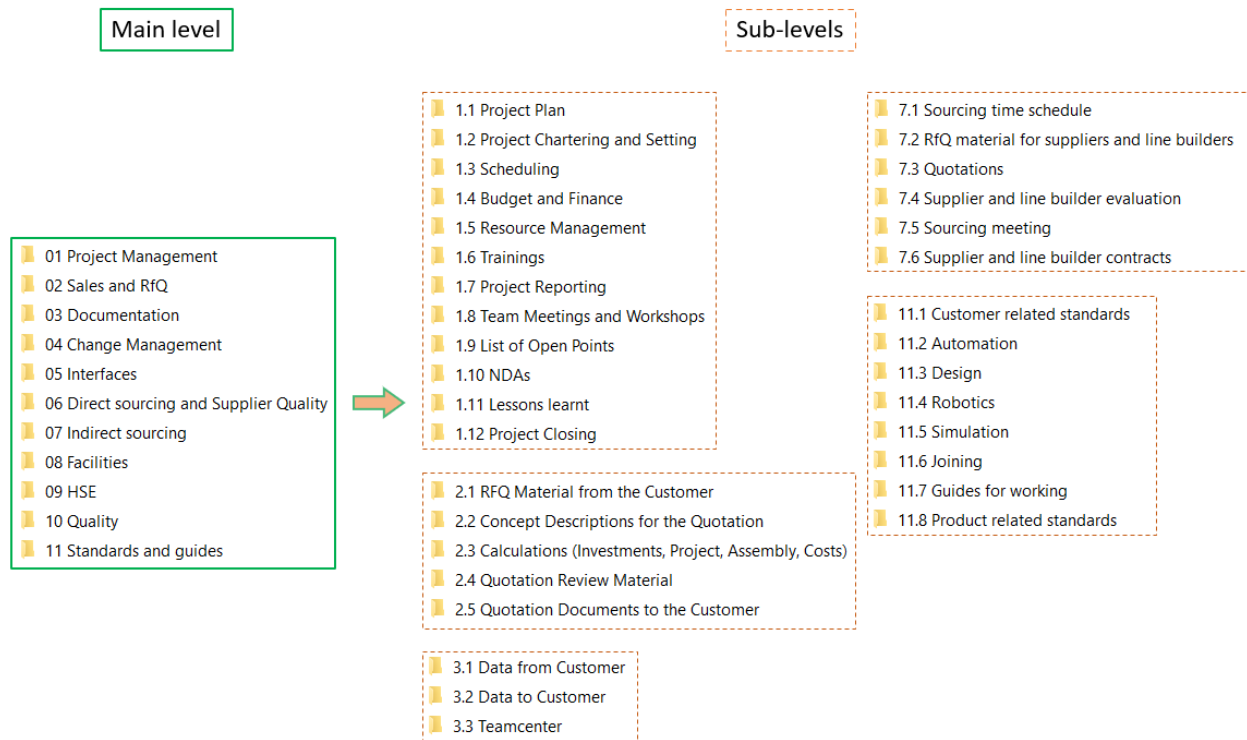


Figure 16. Folder structure

Note. The figure only includes some examples of the sub-levels

The folder structure was included in the 'PMO toolbox' for optimal accessibility to all project managers in the project planning phase. PMO toolbox is a shared storage location for project management-related standard documentation.

5.3 Documentation list

The documentation needed for efficient project work was scattered in different storage locations. As different documentation is managed by different departments, the possibility of a centralized storage location was eliminated. For the ease of the project members to find the right templates, standards, and guidelines, a list was created with links to all the project management-related documents for the target department. Other departments were also encouraged to follow suit.

Although, the project execution handbook contains embedded links to all the project management documentation, a separate list had to be created for ease if the need was only to find documents. The documentation list contains the name of the document, an active link to the accessible storage location, and the owner of the documents (specific person or department). Some documents were work in progress and the link was marked as pending. The task to finalize the pending documentation was added to a 'list of open points' and assigned to relevant responsible persons. Currently, 52 documents are listed. More documents will be added, and the list needs to be kept updated according to the needs. An example from the list can be seen below in Table 7:

Table 7. Project management documentation list

Note. The table only includes some examples from the list and names were removed for privacy

PEH Templates, Guides, and Standards List				
No.	Template	Storage location	Link	Owner
1	ME Project Execution Handbook	Teamcenter	ID 329903	Name
2	ME BS Project plan	Server folder	Link	Name
3	Main Project organization matrix	PMO toolbox	Link	PMO
4	BS Project absences, remote work calendar	Sharepoint project folder	10.1 - 1.5.4	Name
5	RASI (internal)	PMO toolbox	Link	PMO
6	RASI (external)	PMO toolbox	Link	PMO
7	ME inter-departmental RASI		Pending	Name

5.4 Implementation of the results

The results of the development work would only be fruitful if implemented successfully across the target department. It was necessary to train the personnel about the developed framework, documentation list, and folder structure. The importance of following a standardized department-wide framework had to be explained. The personnel would be intrinsically motivated if they realised how the framework can make their work easy and efficient.

Training workshops were designed to be interactive and open discussions were encouraged. The effectiveness of the training was ensured by following a combination of approaches such as:

- Before the workshop, a review link to the project execution handbook was sent to all the participants. It gave them a chance to familiarise themselves with the content beforehand and add direct comments to the document wherever necessary.
- At the beginning of the workshop, participants were shortly briefed about the existence of project management methodology documents: Project execution handbook, Project-related documentation list, and standardized folder structure. Participants were then shown the storage locations for the developed documents.
- Sticky notes were provided to participants for noting down the challenges they face in everyday work and propose relevant solutions if known.
- The whiteboard was divided into project phases. Sticky notes were then sorted accordingly and stuck under the corresponding phases. (See Figure 17)
- Participants who participated virtually, were also given the opportunity to anonymously make virtual sticky notes on the Microsoft Teams app following the same sorting approach.
- Each topic was briefly discussed, and the corresponding solutions offered by the newly developed project management methodology were pointed out.
- A few topics were identified as not having been covered in the methodology documentation. Participants were assured that these will be implemented in the upcoming revisions of the documentation.
- The uncovered topics were analysed and implemented in the following revision
- A follow-up briefing was planned to be held to inform the participants about the further development of their proposals.

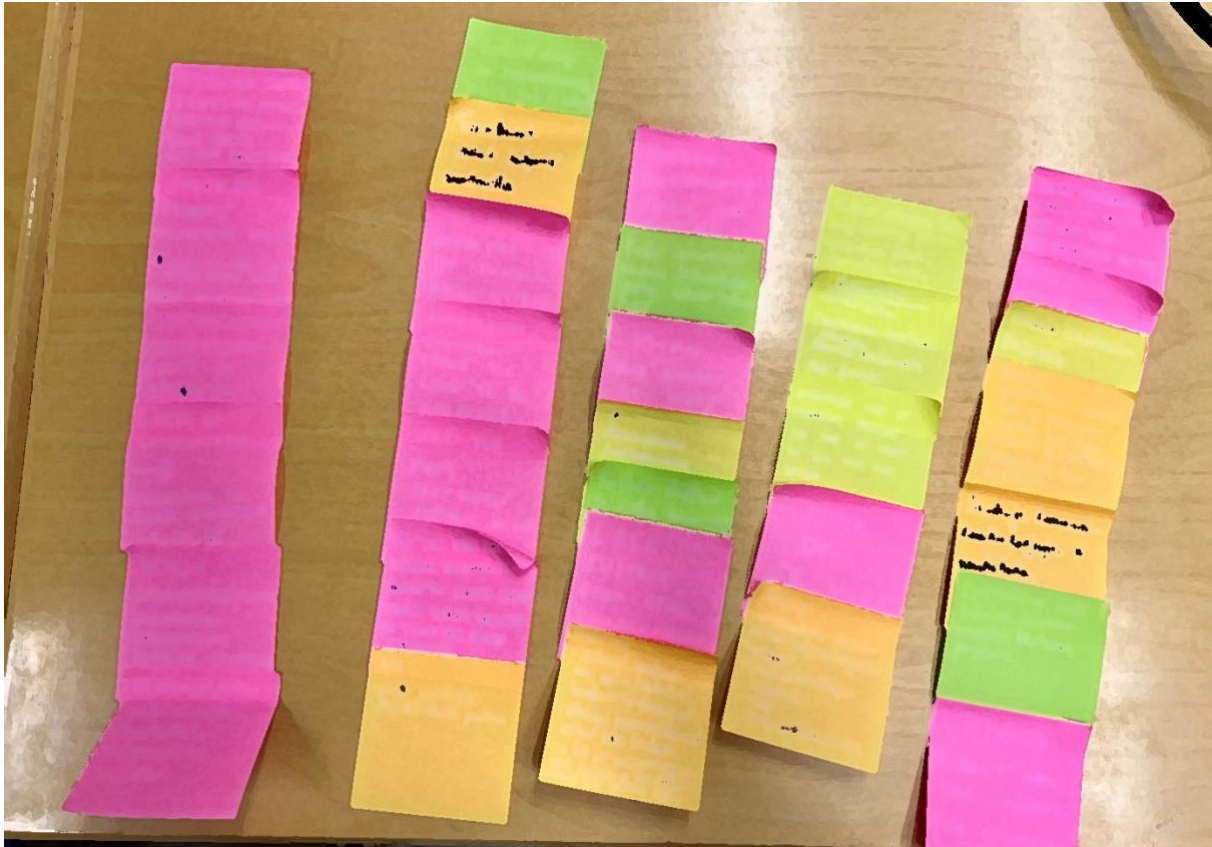


Figure 17. Training workshop sticky notes

Note. Text is blurred for the secrecy of business practices

Further training workshops are planned to be held before the initiation of future projects to ensure the results are implemented in practice.

5.5 Further development plan

As mentioned, in-depth in section 3.3, continuously improving project management methodology according to business needs is extremely important. It is a very resource-intensive process and needs commitment from all the team members to provide feedback and improvement proposals.

Suggestions made to the target department:

- **List of open points:** Some company-specific templates and standards were identified to be missing. So, an Excel sheet was made for listing and tracking open points needed to further develop the project management methodology.
- **Documentation list:** The list of project management documentation includes all the currently identified project management documentation. When used in future projects, the list should be extended to include documents that might have been missed out. If the

storage location or owner of any listed document is changed, it should be reflected in the list.

- **Assumptions log:** Assumptions must be made by the target department while quoting for a customer project. The timeline to prepare quotations is short, and insufficient data from the customer can lead to assumptions being made by the technical team. A log of the made assumptions is extremely necessary as it can have a major impact on the project scope and/or budget and/or timeline. If the quotation is nominated and it turns into a project, all the assumptions need to be considered and compared against the complete data when received.
- **Change log:** A change log is needed for various purposes during the project lifecycle (e.g., during technical phases, for suppliers, project-related changes, product-related changes, etc.). A standardized template needs to be finalized.
- **Supplier and line-builder status report:** A standardized template to track the status of suppliers and outsourced scope should be made.
- **Centralized storage location:** Finding a solution for a centralized storage location for all documentation can hugely improve the efficiency of the target department. Currently, different storage locations are used for different documentation (SharePoint, PDM system, common server, etc.).
- **Practical loop:** The target department needs to implement the framework developed in the upcoming projects and make modifications as necessary. The practical loop as mentioned in section 2.5 in Figure 4 needs to be implemented continuously.
- **Tailoring for projects:** As mentioned in ISO and PMI standards, the guidelines always need to be tailored for different projects. As projects are getting increasingly complex, no two projects are the same. So, necessary adjustments will be needed before initiating future projects.
- **Checklists:** The Target department was notified to develop missing checklists for various functions to ensure the deliverables and their quality.
- **Implementation across departments:** The development work was carried out for a particular department. It would be highly beneficial in future to align and expand the methodology to accommodate other departments of the organization.

6 Conclusions and Discussion

6.1 Reliability of the study

Researcher bias can arise when researchers have a predisposition to observe subjects and interpret results based on their values. This bias may manifest in selectively observing and recording specific data while neglecting other relevant information. (Brink, 1993, p. 36). To negate the effect of the bias, member checks and expert validations are suggested by Brink (1993, p. 37).

Member checks involve recycling the analysis by providing conclusions to informants and seeking feedback on the accuracy of the content. By sharing the findings with informants and inviting their input, this process ensures a consistent interpretation of the data between the researcher and the informants. (Brink, 1993, p. 37). As mentioned in the study, a review link was provided to participants for feedback to ensure the data was analysed and implemented objectively. The review link provided was to the master document, so participants were able to check and comment anytime on the latest working revision.

The author himself is a team member of the target department. Familiarity with the business, culture and employees, can both be advantageous as well as bias-inducing. According to Brink (1993, p. 37), "Expert Consensual Validation entails seeking input and validation from individuals knowledgeable about the topic under study at different stages of the research process. This includes having others, such as research colleagues, a panel of experts, or participant informants, independently analyse the data. Their perspectives and evaluations contribute to the validation of the research findings and enhance the credibility of the study". Measures were taken to eliminate the bias. Semi-structured interviews ensured the elimination of researcher bias as the participants were allowed to tangentially include the topics not in the agenda. Additionally, the project execution handbook was created as a team with other supporting resources from the target department. The results were weekly validated with the subject matter expert (a representative from the commissioner's side) in core team meetings. Experts from other departments were also provided review links to the handbook to collect unbiased feedback.

6.2 Discussion of the main results

6.2.1 Project execution handbook

The project execution handbook is structured according to the tailored project lifecycle. The tailored lifecycle consists of the following phases (in chronological order): RFQ phase, Planning phase, Execution phase, and Closing phase.

The RFQ phase includes:

- A clear workflow of the phase
- Guidelines to create a project schedule skeleton
- Identification of stakeholders
- Technical considerations
- Clarification of departmental RASI
- Guidelines for collaboration with other departments
- Checklist of deliverables

The planning phase includes:

- A clear workflow of the phase
- Guidelines for creating a project plan
- Resource planning guidelines
- Guidelines for communication planning
- Guidelines for finance planning

The execution phase includes:

- Project kick-off checklist
- Implementation of previous lessons learnt
- Implementation of standardized folder structure
- Data storage guidelines
- Resource management guidelines
- Financial management guidelines
- Schedule management guidelines
- Procurement guidelines
- Technical phase guidelines

- Quality management guidelines
- HSE guidelines
- Change management guidelines
- Project reporting guidelines

The closing phase includes:

- Checklist for project closing
- Guidelines to create a project closing report
- Lessons learnt process

All the relevant guidelines include workflow, checklists, schedule and, other considerations for the knowledge-areas as identified from the qualitative data analysis. The project execution handbook will be treated as a sole document to guide the approach to various project processes for the target department. The handbook also contains embedded links to relevant standards, guidelines, handbooks, templates, etc. Detailed content of the handbook is described in Table 6 in section 5.1.

6.2.2 Project management documentation list

A literary review of various project management methodologies highlighted the importance of project management documentation, its quality and accessibility. The project management documentation list is a collective list of all the templates, standards and, guidelines needed during a project lifecycle. The list includes the title of the document, link to storage location and, owner of the document. Although the links are also included in the handbook, having a separate list makes it easier for the personnel solely looking for specific documents during a project. It improves work efficiency by improving accessibility to documentation and reducing wasteful time in finding them. A preview of the list can be seen in Table 7 in section 5.3.

6.2.3 Standardized folder structure

Since the project initiation and throughout the project lifecycle, it is extremely important for all the project-related documents to be well-organized. The documents should be logically structured in a manner that is familiar to the whole team. So, a standardized empty folder structure was created for the target department according to the inputs from team members.

The main level of the folder structure includes all the main functions of a project listed below in chronological order:

- Project Management (project plan, project schedule, finance documents, project reports, organization chart, RASI, NDAs, List of Open Points, etc.)
- Sales and RFQ
- Documentation (Documents officially sent to the customer and, received from the customer)
- Change management
- Interfaces (for documents concerning collaboration with other departments)
- Direct sourcing
- Indirect sourcing
- Facilities
- HSE
- Quality
- Standards and guides (both commissioner's and customer-specific)

The sub-levels contain more specific folders to further organize the documents. Some examples of sub-levels can be found in Figure 16 in section 5.2.

6.2.4 Implementation process development for target department

The methodology and documents created would only meet their full potential if implemented well across the department. So, an interactive training workshop approach was developed for the target department. The approach is a combination of characteristics such as: improving intrinsic motivation by providing examples, convincing by realization of personalised benefits, collecting feedback for further improvement at the same time and improving personnel engagement. The training method was proven to be very effective and received highly positive feedback from the participants.

6.3 Conclusions

The main aim of the thesis was to develop a tailored project management methodology for the ME department of an automotive company. The ultimate goal of any project management methodology is efficient project management resulting in project success. The process to reach

the goal can be different for different businesses. Thus, it is highly beneficial for any organization with specific needs to have well-documented and tailored project management guidelines. It improves efficiency, effectivity, communication, chances of success and, motivation of the team. Furthermore, it provides clarity to all the stakeholders as well as team members and, gives businesses a competitive edge.

For developing tailored guidelines, it is extremely important to have a combination of qualitative research methods. Research methods like interviews and focus groups can provide a deeper insight into internal best practices as well as a big-picture understanding of the objectives for the development work. No company is perfect in their approaches. So, benchmarking with various applicable international standards can provide a great baseline to compare against. Any missing practices and/or improvement opportunities are easy to spot while benchmarking. It is equally important to test those guidelines in practice, test, improve and, standardize as per the needs.

There exists a lot of literature about the benefits of a tailored approach to project management. However, very few studies provide the detailed process of developing a tailored approach. This study will fill the identified gap in the existing literature on project management standards. It provides a new perspective and a starting point for further research in the field. Additionally, any organization with a similar core business can directly use the results with just minor modifications to accommodate their specific needs.

This research study has some limitations:

- Although the guidelines are developed as a result of qualitative data collected from years of experience and, benchmarking against international standards, it hasn't been practically implemented and tested. Due to the timeline of the ongoing projects and business situation, practical testing wasn't possible.
- The guidelines are developed for a business with a very particular technical scope of the project. So, the results aren't directly applicable to other businesses with different technical scopes. However, the approach remains the same.
- The study is based on a traditional 'waterfall project management' approach. For organizations with any form of agile approach, the study might not be applicable.

- The study uses internal expertise as a starting point for the development work. So, it might not aid the researchers seeking to develop methodology from scratch.
- The interviews and focus groups were conducted in English, some participants with limited English language skills might not have been able to contribute their full potential due to the language barrier.

All things considered, having optimal tailored guidelines for project management is a continuous development process for any organization. Ensuring the commitment of personnel by motivating them to implement and improvise the standard methodology is the key to project success.

6.4 Further research considerations

Firstly, for additional research, the author suggests supplementing the implied research methods with 'action research'. This might provide new insights when the researcher has expertise in the subject. On the contrary, this can also induce researcher bias. Referring to the literature regarding the elimination of various biases can be a counteractive measure.

Secondly, conducting a similar study for an organization following agile methodology will further fill the gap in the existing literature. As waterfall and agile are two completely different philosophies of project management, the research can bring new insights to the field of tailoring process.

Thirdly, it can be highly advantageous to gather more data by conducting additional interviews with experts from different companies with similar businesses.

Lastly, conducting multiple similar studies for different organizations can spot the shortcomings of the study and further add to the knowledge base.

7 References

- Söderlund, J. (2011). Pluralism in Project Management: Navigating the crossroads of specialization and fragmentation. *International journal of management reviews : IJMR*, 13(2), 153-176. <https://doi.org/https://doi.org/10.1111/j.1468-2370.2010.00290.x>
- Do, D. (2017, August 5). *What is Continuous Improvement (Kaizen)?* Retrieved November 30, 2023, from The Lean Way: <https://theleanway.net/what-is-continuous-improvement>
- Whitetaker, S. (2014, September). *The Benefits of Tailoring: Making a Project Management Methodology Fit*. Retrieved November 30, 2023, from Project Management Institute: <https://www.pmi.org/learning/library/tailoring-benefits-project-management-methodology-11133>
- Dodgson, M., & Trotman, A. J. (2022). Lessons Learned: Challenges When Conducting Interview-Based Research in Auditing and Methods of Coping. *Auditing : a journal of practice and theory*, 41(1), 101-113. <https://doi.org/https://doi.org/10.2308/AJPT-19-098>
- Wilson, V. (2016a). Research Methods: Interviews. *Evidence Based Library and Information Practice*, 11(1(S)), 47-49. <https://doi.org/https://doi.org/10.18438/B8404H>
- Wilson, V. (2016b). Research Methods: Focus Groups. *Evidence based library and information practice*, 11(1(S)), 44-46. <https://doi.org/https://doi.org/10.18438/B87S64>
- Andersen, B. (2007). *Business process improvement toolbox* (Second ed.). ASQ Quality Press.
- Wells, K. N., & Kloppenborg, T. J. (2015). *Project management essentials* (First ed.). Business Expert Press.
- Project Management Institute. (2017). *A guide to the Project Management Body of Knowledge (PMBOK Guide)* (Sixth ed.). Project Management Institute.
- Project Management Institute. (2023). *Process groups : a practical guide*. Project Management Institute.
- International Project Management Association. (2018). *Project Excellence Baseline for achieving excellence in projects and programmes*. International Project Management Association.
- Beck, S. E., & Manuel, K. (2008). *Practical research methods for librarians and information professionals*. Neal-Schuman Publishers.
- International Project Management Association. (2015). *Individual Competence Baseline for Project Management*. International Project Management Association.
- Thamhain, H. J., & Riedy, D. (2014). *Managing technology-based projects: Tools, techniques, people, and business processes* (1st ed.). Wiley.

International Organization for Standardization. (2012). *Guidance on project management (ISO 21500:2012(E))* (First ed.). International Organization for Standardization.

Schreier, M. (2012). *Qualitative Content Analysis in Practice*. SAGE Publications Ltd.

Oliver, P. (2010). *The student's guide to research ethics* (2nd ed.). McGraw-Hill Education.

Brink, H. (1993). Validity and reliability in qualitative research. *Curationis*, 16(2), pp. 35-38.
<https://doi.org/http://dx.doi.org/10.4102/curationis.v16i2.1396>

International Organization for Standardization. (2021). *Project, programme and portfolio management - Guidance on project management (ISO 21502:2021)*. International Organization for Standardization.