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Action Plan to Manage Customer Projects

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After all these working years of my life in Finland, I decided to apply for further studies. I got admitted and was very happy to start. I put my work on pause and committed 100% to the school. However, it did not last long as a new working opportunity came along within the first two months of school and a decision had to be made. It was quite hectic to manage a new job and school at the same time. Nevertheless, the thesis is now ready, and I am waiting for a beautiful summer.

I remember the days when I woke up very early in the morning and started to drive from Tampere to Espoo. Luckily, I had my dear friend and fellow Master's student Vikash mostly with me in the car to have long discussions about the school and the assignments. We faced together the beautiful autumn mornings, harsh dark and snowy weather in winter, and calm and sunny spring mornings. This will stay long in my memory.

I am very grateful that I had an opportunity to write a thesis for my case company. All the support and flexibility provided were incredibly helpful. I especially would like to thank Jani, the design director, who provided a good environment to work and insights into the topic related to the thesis. I would also like to thank my colleagues for the encouragement and those who were directly or indirectly involved in the meetings and workshops.

I would like to thank the lecturers, especially my thesis instructor and Principal Lecturer Dr Thomas Rohweder. Without his guidance and instructions, it would not have been possible to finish the Thesis. I would also like to take my time to thank M.A., Senior Lecturer Sonja Holappa for helping with my language and writing. I am thankful to all related to our IM department, including all the lecturers and my friends studying together.

A special thanks to my lovely wife for her support during my studies. It meant everything to me.

Prabin Sharma, Tampere, 15th May 2023

Abstract

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The case company in this Thesis had multiple projects running at the same time. The projects were managed with certain methods and tools that were developed over time. Some methods and tools were effective; however, some needed to be upgraded. The objective of the thesis was to propose an action plan to tackle the incompleteness and issues that emerged in the case company while managing customer projects. The objective of the study was limited to proposing an action plan to the Design and Engineering department. However, it does not promise the implementation of the action plans.

The study followed Design Research to find a practical solution to issues that the case company was facing. First, the conceptual framework was created to find the best methods and tools available. Secondly, a current state analysis was completed to identify the strengths and weaknesses. Thirdly, the initial building of proposed actions was co-completed with the stakeholders to integrate the strengths into the action plan and overcome the weaknesses. Lastly, the validations of the initially proposed actions were done to get a concrete conclusion from the thesis.

The outcome of the thesis is the action plan to manage customer projects, which are divided stage-wise; the Initiating and Planning Phase, the Execution Phase, and the Evaluation and Closing Phase. The outcome of this study is also the suggestions for practical methods and tools that can be implemented shortly with some or very little investment, which eventually help a project run more efficiently and promotes better communication. The expertise and resources will be improved, also strengthening the organization's base.

Keywords: Action Plan, Project Management, Methods and Tools to Manage Customer Projects, Time and Resource Management, RACI Chart, CPM, S-Curve

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List of Abbreviations

CSA:	Current State Analysis
CAD:	Computer-Aided Design
EUR:	Currency Euro
WBS:	Work Breakdown Structure
Vs:	Versus
CPM:	Critical Path Method
ESS:	Early Start Schedule
LSS:	Late Start Schedule
ES:	Early Start
EF:	Early Finish
LS:	Late Start
LF:	Late Finish
KPI:	Key Performance Indicator
DD:	Design Director

1 Introduction

Many companies manage their projects by keeping track of their project from start to finish with different methods and tools available. Some follow the traditional concept of handling projects which have been developed over time and some tend to upgrade the project handling tools and methods with the modern tools and studies available. The ultimate goal is to find suitable concepts, tools, and methods which are effective, efficient, and learnable even with personnel changes in the company.

Projects that deal with events, developments, or business frequently fail because funding cannot be secured, deadlines or quality requirements cannot be reached, budgets go over, or teamwork is so severely hampered by communication issues that the project must be abandoned. Many of these issues may be avoided by using project management, which can also guarantee that high-quality events and other kinds of projects are organized successfully. This makes it feasible for an organization to respond quickly and adapt to the needs of its internal and external environments (Verhaar & Eshel, 2013, p. 14).

This study focuses on the methods and tools to manage customer projects in an industrial organization.

1.1 Context of the Case Company

Case Company is a small-sized company that designs, develops, and produces automatic electronic door systems for public transportation such as trains, trams, and buses. The company is located in Northern Europe and it has no sub-divisions. The turnover of the company is around EUR 7 million annually and it has 47 employees. The company has nearly five decades of experience and is one of the leading players in the industry in Northern Europe.

The case company delivers the doors designed to the customer company and is mostly used for trams and buses in Europe. The doors include precise

engineering and are equipped with safety equipment to work for many years even in extreme temperatures from -40°C to +40°C.

1.2 Business Challenge, Objective and Outcome

Case Company has come a long way from designing products by hand with the help of big scales, pens, and paper to using Computer-Aided Design (CAD) systems to design the products. During this technological revolution, it has also adopted new advanced machinery to produce products more efficiently. The prototype design and testing are done with the new technology. The production department is also assisted with the ERP system to some extent. However, it is very limited to self-improved methods and project management tools at the moment. This concept to manage projects is not very effective and needs to be improved.

The objective of the study is to propose actions to manage customer projects. The customer project starts in the case company with the sales department providing an initial offer to the customer. When the offer is accepted, the initial design process starts. After a deep, careful discussion with the customer, the design is locked and the prototype is made. The testing is done in the presence of the customer on the production site. After the feedback about the prototype from the customer, the prototype is finalized and mass production is started. The distribution process starts after all the products are produced. The final handover and the feedback collection are the final steps of the projects in the case company. These above-mentioned steps need an improvement in methods and tools so that the project meets the deadlines and requirements and brings value to the case company.

The outcome of this study is the proposed actions to manage customer projects.

1.3 Scope and Outline of the Study

This study focuses on proposing an action plan to manage customer projects but does not concentrate on the implementation of the action plan in the case company. The study is conducted in the Design and Engineering department and does not cover all the departments of the case company.

There are a total of 7 sections in this study. The first section is the Introduction of the case company. This section describes the context of the case company and overall, the circumstances of the company operating. The business challenge, objective, and outcome are also described in this section.

The second section is Project Plan. This includes the research approach and the reasons behind choosing that particular research approach. The Research Design gives the idea of how the study is going to be conducted with the research approach chosen. The data collection mediums, informants, the data timing, and the outcomes of the data plan are stated also in this section.

The third section is the investigation of the Conceptual framework as the study topic is very unknown to the researcher. This includes studying the available methods and tools from the literature. The available literature is studied carefully which provides up-to-date information about managing a project. The tools and methods are also studied to make an initial idea.

The fourth section is the Current State Analysis. This is done to understand what kind of methods and tools are already being used in the case company to manage projects if available at all. The subsections are CSA methods and the outcome of the CSA.

The fifth section is Solution development. This contains a step-wise initial action proposal and outcomes.

The sixth section is Validation. This gives the overview and summary of the validation of the recommendation. The feedback and changes are also described in this section.

The final and seventh section is the Conclusion. This section reflects on the findings, recommendations, and feedback.

The following section is the Project Plan, which describes the subchapters of the Research Approach, Research Design, and Data Collection.

2 Project Plan

This section of the study focuses on the research approach and the reasons to choose the right one. The research design is also explained briefly with different stages. This section also includes analysis and data collection methods.

2.1 Research Approach

There are mainly two different methods available to choose from for the Research Approach, one is Basic Research and the second is Applied Research.

According to Saunders et al. (2012), the purpose of Basic Research is to study the available theory and build the information of processes on the top. The principles are not limited to the individual organization but globally and it creates value for society with meaningful findings. The research is conducted in universities with topics and objectives chosen by the researcher. Also, it is not very time critical to finish the research.

On the other hand, Applied Research focuses on the selected business or management issue. This research has a practical approach to finding the practical solution for that particular issue with findings of new information. This process generates value for the particular organization. The research has tight time scales and objectives are presented by the person or the organization facing the issue according to Saunders et al. (2012).

Applied research targets identifying a fix for a problem in an industrial or commercial company currently experiencing according to (Kothari, 2004, p. 3).

According to Kananen (2013), Design Research is like a cycle of process steps that follow each other and is a matter of proceeding development. It results in operative and valuable solutions with the combination of development and research. Moreover, it is done in businesses to enhance operations.

Design Research was chosen as the research approach for this study with qualitative methods. The motive for this choice was that it seems to be the best approach for finding out about the issues the case company is having with its project management process and tools. The issues are addressed with the help of interviews, observations, and documents.

The Quantitative Method, which involves gathering and analyzing numerical data for statistical analysis, is contrary to qualitative research (Bhandari, 2020).

The Qualitative Method, in turn, contains gathering and evaluating non-numerical data (such as text, video, or audio) to better get ideas, opinions, or experiences. It can be utilized to uncover complex details about a situation or to bring out fresh study concepts (Bhandari, 2020). This thesis uses qualitative methods for collecting and analyzing data to achieve the objective.

2.2 Research Design

Planning the research included considering the order of the research stages and the data collection points as well as the outcomes of the different stages. Figure 1 below shows the Research Design for creating an action plan for project management in this study.

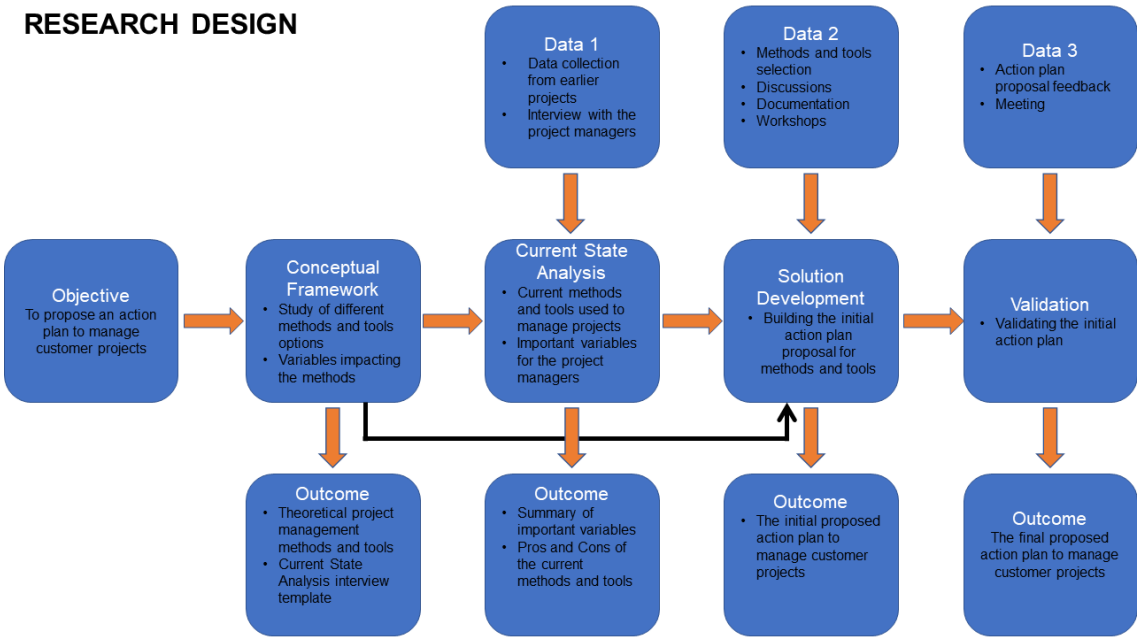

Figure 1. Research Design of the study

At the time of doing this study, the researcher was fairly new at the case organization as he was offered a new challenge. The research topic was also unknown to the researcher at the time. Thus, the Conceptual Framework was chosen as the first stage.

The Research Design includes three different stages for CSA, Solution Development, and Validation as shown in Figure 1 with the help of documents from the earlier projects, one-to-one interviews, discussions, and workshops. These different data collection methods give different opportunities to express the perspective on project management. This is very important for the study because the data providers might not fully open up in group discussions but in one-to-one interviews and vice-versa.

The outcomes of each stage are like ladders to climb in this study. The next stage is always built upon the outcome of the earlier stage and thus is crucial to develop methods and tools to manage customer projects.

2.3 Data Collection

The data for this study is collected from different documents available from the database of the case organization. Also, one-to-one interviews and workshops are conducted to collect data involving the experts directly or indirectly utilizing the project management concepts of the case organization. The data is collected in 3 different stages as shown in the table below.

Table 1. Data Plan

DATA PLAN					
	CONTENT	SOURCE	INFORMANT	TIMING	OUTCOME
DATA 1 CURRENT STATE ANALYSIS	-Current methods and tools used to manage projects -Pros and Cons -Important variables	-Earlier project management documents -Interviews	-Project Manager 1 -Project Manager 2 -Project Manager 3 -Project Manager 4	FEBRUARY - MARCH	-Summary of important variables -Pros and Cons of the current methods and tools
DATE 2 SOLUTION DEVELOPMENT	-Initial action plan proposal	-Workshop Session	-Project Manager 1 -Project Manager 2 -Project Manager 3 -Project Manager 4	APRIL	The initial action plan proposal to manage customer projects
DATA3 VALIDATION	-Evaluation and feedback	-Meeting	-Design Director	APRIL	-The final proposal of the action plan to manage customer projects

As shown in Table 1 above, the full details of the data collection process are recorded for CSA, Solution Development, and Validation stages respectively starting from content to source, informant, timing, and outcome.

First, the documents related to project management from the earlier projects are discussed with project managers to collect data during February and March for CSA. Also, the project managers are interviewed at the same time. During the Solution Development Stage, the workshops are held with the same participants from the CSA stage to collect data during April. To follow the tight schedule, interviews are conducted with only project Managers and the design director during April for the data collection for the Validation stage.

This summarizes the Project Plan section. The next section describes the Conceptual Framework built for utilizing the best tools and methods available for project management.

3 Conceptual Framework

This section discusses how a project should be run ideally with best practices available from the literature. The section first discusses the background knowledge needed to manage a project and then proceeds to the investigation of tools and methods needed to create an action plan to manage projects.

3.1 Initiating and Planning Phase

Steps such as project proposal, assessment, project definition, and analysis are made while initiating and planning the project. The value evaluation of the project is also a very important step while Initiating and Planning Phase. The work breakdown structure gives an overview of the project and the steps to initiate. This section describes the steps before the project is executed.

3.1.1 Work Breakdown Structure (WBS)

The WBS's basic premise is that hard jobs can be broken down into smaller ones until they reach a level where further division is impossible. At that point, estimating the time and money required to complete the tiny work is typically simpler than estimating similar details for the higher levels. (Lewis, 2006, p. 57).

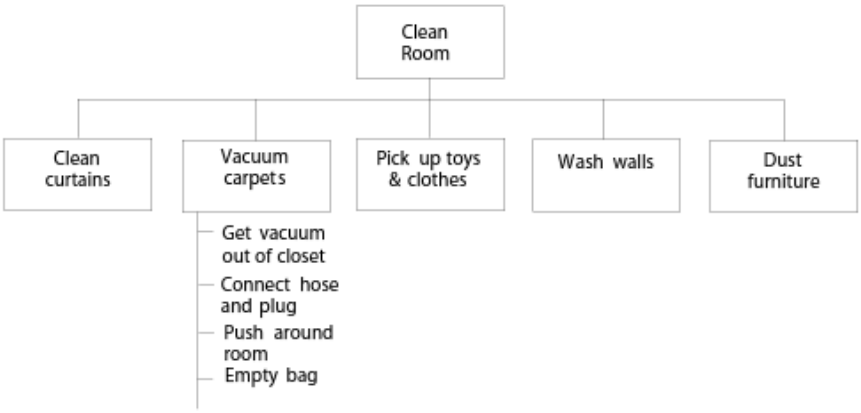

Figure 2. WBS diagram to clean a room, as depicted by Lewis (2006, p. 57)

As seen in Figure 2, the simple task of cleaning a room is divided into several small tasks. The tasks mentioned are not in a particular order. WBS breaks down a bigger task into many smaller tasks but does not define a sequence of the tasks that should be completed.

A top-down hierarchical chart of the tasks and subtasks necessary to accomplish the project is called a work breakdown structure. The focus of the work breakdown structure can be on a product, a function, or anything else that clarifies what needs to be done. (Olson, 2020, p. 4).

The below example (Figure 3) to Install Decision Support System for Purchasing Manager is a bit more complex example than the earlier one of cleaning a room. The WBS for this task is shown below.

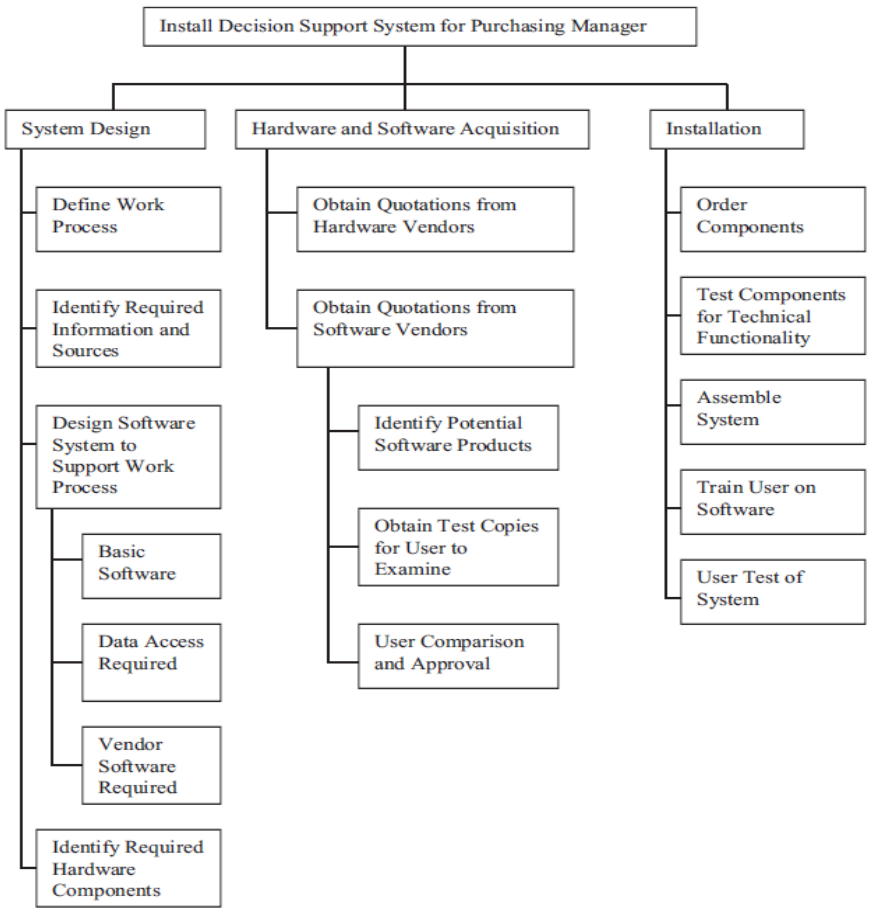

Figure 3. WBS diagram as depicted by Olson (2020, p. 4)

As shown in Figure 3, the task of installing a Decision Support System for Purchasing Manager is divided into 3 subtasks and these subtasks are also divided further into microtasks. The idea of this WBS diagram is to show how a bigger task in an organization can be broken into smaller tasks to get a bigger picture of what should be done and how micro tasks and subtasks are important to complete a bigger task.

3.1.2 Responsibility Matrix

A responsibility matrix is a tool for assigning work to people based on their responsibilities. With the help of such a matrix, management can rapidly determine who is in charge of each task in complex projects. This matrix can be used to identify what needs to be done and compare it to candidates' talents while assembling the project team. (Olson, 2020, p. 9).

The tasks are broken into smaller ones, and responsibility is divided according to their expertise. Figure 4 below depicts the responsibility matrix for the Installation of a Decision Support System for Purchasing Manager.

Installation of Decision Support System for Purchasing Manager

Tasks	Subtasks	SE	HA	SA	TR	User
A	SYSTEM DESIGN					
A1	Define work process	x				x
A2	Identify required information and sources	x				x
A3	Design software system to support work process					
A31	Basic software	x				
A32	Data access required	x				x
A33	Vendor software required	x				x
A4	Identify required hardware components	x				x
A0	System Design Milestone	x				x
B	HARDWARE AND SOFTWARE ACQUISITION					
B1	Obtain quotations from hardware vendors		x			
B2	Obtain quotations from software vendors			x		
B21	Identify potential software products			x		
B22	Obtain test copies for user to examine			x		
B23	User comparison and approval	x				x
B0	Hardware and Software Acquisition Milestone	x				x
C	INSTALLATION					
C1	Order components			x		
C2	Test components for technical functionality	x				
C3	Assemble system	x				
C4	Train users on software				x	x
C5	User test of system	x				x
C0	Installation Milestone	x				x

KEY:
SE software engineer
HA hardware acquisition
SA software acquisition
TR trainer

Figure 4. Responsibility Matrix, as depicted by Olson (2020, p. 8)

As shown in Figure 4, assigning the right tasks to the right person is very important. A software engineer is assigned to different tasks such as defining work processes, designing basic software, and so on and these fall under the expertise of a software engineer. A project advances smoothly when the right responsibilities are shared and documented through Responsibility Matrix. The Responsibility Matrix should be accessible to all team members of a project to understand the project steps and responsibilities.

3.1.3 RACI Chart

(Responsible, Accountable, Consult, and Inform)

According to Olson (2020, p. 8), the RACI charts define clear roles and responsibilities for the project members. If possible, only one project member should be assigned to a particular activity. The member should have the expertise to complete that task. Therefore, only that project member is responsible for the completion of that activity. Accountable are those who are in support of the responsible. As activities can be complicated and need some consultation, there should be a Consult whose expertise helps finish a project. The status of a project needs to be known so that related tasks can be continued and those are called Inform. Figure 5 below shows the basic RACI chart for the Installation of a Decision Support System for Purchasing Manager.

Task	Description	SE	HA	SA	TR	User
A1	Define work process	A				R
A2	Identify required information and sources	R				C
A31	Basic software	R		C		
A32	Data access required	R		C		C
A33	Vendor software required	C	I	R	I	I
A4	Identify required hardware components	C	R			
B1	Obtain quotations from hardware vendors		R			
B21	Identify potential software products			R		
B22	Obtain test copies for user to examine			R		
B23	User comparison and approval	C		C	I	R
C1	Order components	I	I	R	I	
C2	Test components for technical functionality	R	C	C		
C3	Assemble system	R	C	C		
C4	Train users on software				R	C
C5	User test of system	C	I	I	I	R

Figure 5. RACI chart, as depicted by Ohlson(2020, p.9)

As shown above, in Figure 5, any task should have at least R (responsibility) in the matrix so that the task is taken care of. Otherwise, the task will not be completed at all. Task A33 shows that Software acquisition is R(responsible), should be consulted with SE(software engineer) and be informed to HR(Hardware acquisition), TR(trainer), and User. In this way, a Responsibility Matrix gives a wide view of the tasks and project members related to it.

3.1.4 S-Curve

S-Curve is a graph showing total expenses, labor hours, or other quantities over time. The name of the curve originates from an S-like shape, which is normal for most projects. At the beginning and end, the curve is flat but it is steep in the center. While the finish symbolizes a deceleration as the effort comes to an end, the beginning signifies a methodical, deliberate, yet speeding commencement. (Wideman, 2001).

3.1.5 Baseline S-Curve

At the beginning of the project, tasks and resources are divided by scheduling. The curve made by this schedule data is called a Baseline S-Curve. Figure 6 below depicts the example of the Baseline S-Curve.

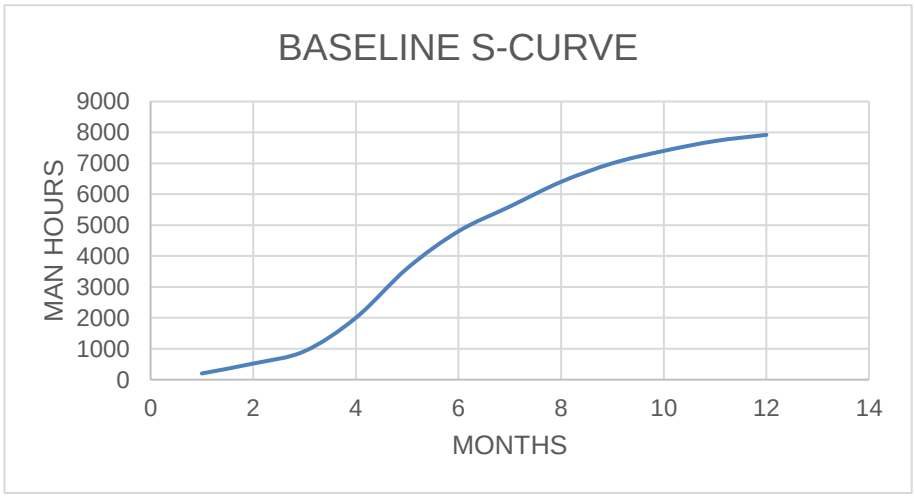

Figure 6. Baseline S-Curve example

As shown in Figure 6, Baseline S-Curve is created to track the progress of the project. If the duration of the tasks changes, the baseline can be adjusted to fill the requirement. Baseline S-Curve has time on the x-axis and Man Hours or Costs on the y-axis. At the beginning of the project, the work is slow because of the training and learning needed by the crew. As this phase is completed, the work takes speed and the curve rises as more manpower is put into the project.

3.1.6 Target S-Curve

Target S-Curve is used to track the progress of the project. The actual work done in the production with the help of the schedule is compared against the time to make the Target S-Curve. Figure 7 below depicts an example of a Target S-Curve.

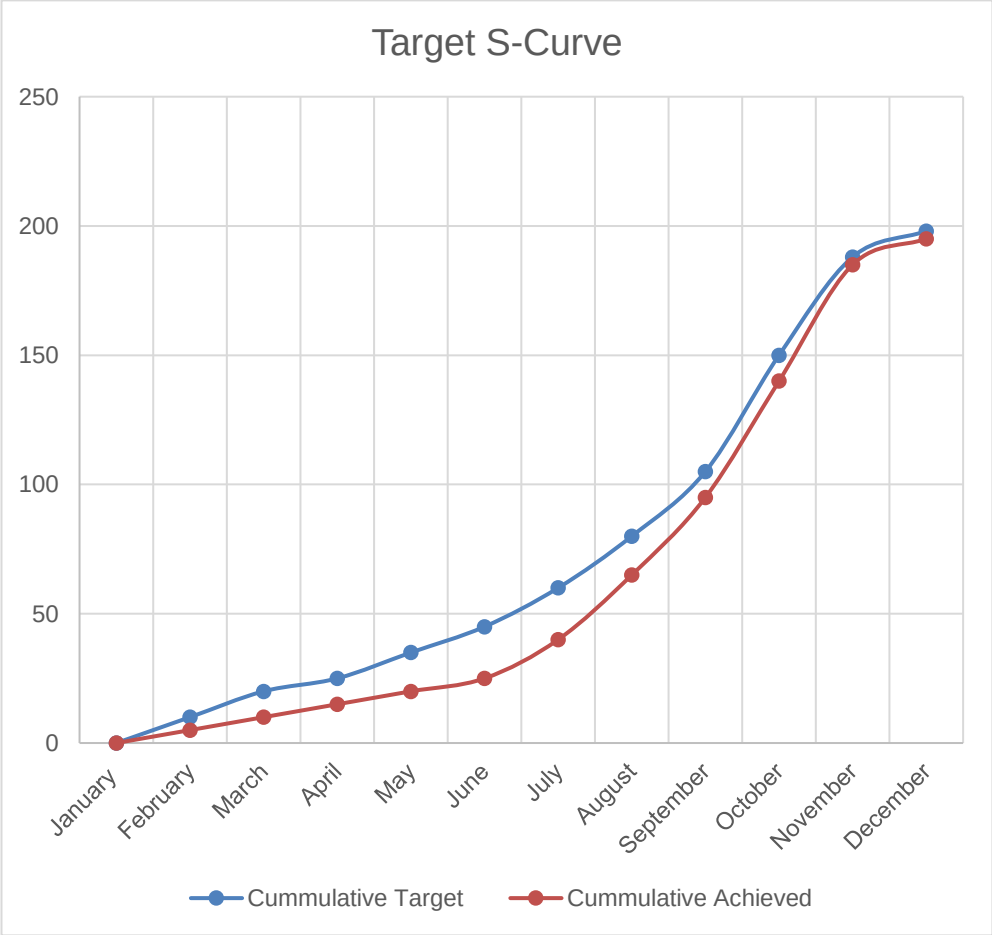

Figure 7. Target S-Curve example

As shown in Figure 7, one curve is made at the beginning of the project as a target, and the real-time curve is made to compare the progress. This is a very good tool for a project manager to use to see what changes could be made to meet the target. The tool can be generated in Microsoft Excel and is easy to do with some basic knowledge.

3.1.7 Schedule

The order of tasks from the WBS, as well as their start and completion dates and linkages to other tasks, are all included in schedules. Schedules include resource requirements in addition to time projections. While using Microsoft Project, resources that indicate the timetable of scheduled activities can be displayed to the right of the bar. Schedules provide a clear plan for everyone and impose structure on the project; as a result, they ought to be shared extensively among team members. (Olson, 2020, p. 10).

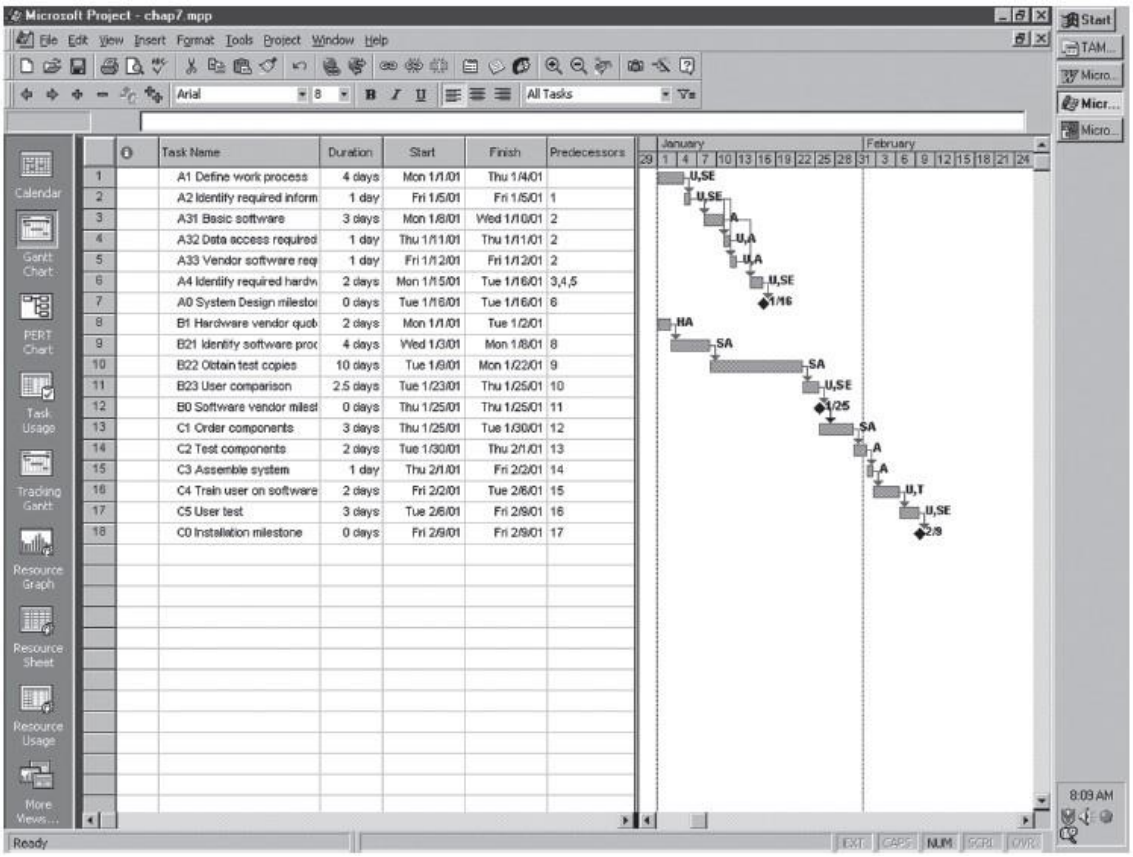

Figure 8. Project Schedule in Microsoft Project, as depicted by Olson (2020, p. 10)

Figure 8 shows the relationship between tasks and their duration to finish in Microsoft Project software. This utilizes CPM with an Early Start schedule. The calendar shows what tasks are getting done in real-time. It also shows the completion date, and the diamond shape represents the milestone in the figure. The activities and their relationship are automatically updated if the duration of Activity A changes. For the example shown above, Activity A2 can only be started after the completion of Activity A1. If Activity A1 is late to finish and takes 4 days instead of 4 days then, Activity A2 and also other activities related are automatically updated and start accordingly.

3.2 Execution Phase

The second phase of project management is the Execution Phase. This phase is where the real action happens and is the longest and most complex of all. The use of project planning tools and methods is the base for project execution. However, the project fails if the project planning is not implemented properly at this stage.

3.2.1 Critical Path Method

Referring to Olson (2020, p. 25), when anticipated activity durations are accurate, the critical path method makes it simple to determine when a project can be finished. The critical path method offers a valuable study of which tasks are time bottlenecks, even though anticipated durations frequently differ from real results. A list of each action, its anticipated length, and the activities that immediately precede it serve as the input to the critical path method. The predecessor activity must be finished before the subject activity can start. (Olson, 2020, p. 25).

In simple words, CPM gives the fastest duration to finish a project. It helps to determine which activities are critical and should not be delayed. It shows the relationship between activities. For example, if one activity holds the key to opening a door for the next activity, then the activity must be finished first.

The CPM assumes that the resources are unlimited and it is rarely true in a real company. Also, it needs the duration to finish each activity. If a project consists of several activities with an unknown duration, CPM is not the best method to carry on.

3.2.2 Early Start Schedule

An Early Start Schedule also known as the first pass gives the idea of how a project can be finished as early as possible. If the activity is not dependent on other activities, then those are started as soon as possible. The remaining activities are started after their predecessor activity is completed. All project activities are dependent on time and the sum of the durations of all activities is the earliest the project can be finished. Table 2 below shows the Early Start Schedule.

Table 2. Early Start Schedule, as depicted by Olson (2020, p. 27)

Activity	Early start	Early finish	
A Estimate cost to complete project	0	12	Releases B
B Bid job and complete contract	12	12 + 1 = 13	Releases C and D
C Build system	13	13 + 40 = 53	
D Develop training	13	13 + 20 = 33	With C, releases E
E Implement system	MAX(53,33)	53 + 5 = 58	

Table 2 above can be represented with a network to give a clearer view of the relationship between activities. According to Olson (2020, p. 27), Networks are particularly helpful in separating the relationships for late start schedules, but they are not necessary for the creation of early start schedules. They also offer managers a useful visual tool for identifying connections between various tasks.

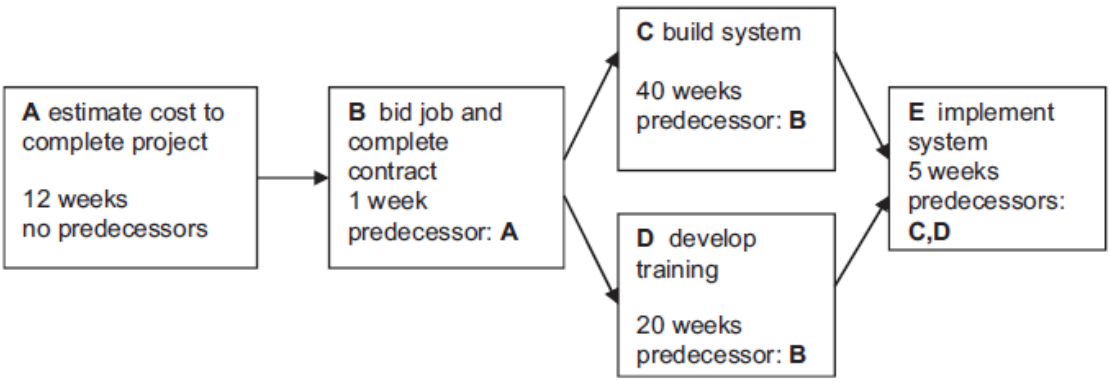

Figure 9. Network, as depicted by Olson (2020, p. 27)

As shown in Figure 9, Activity A has no predecessors and can be started immediately. B starts after the completion of Activity A and releases C and D. Activity E, however, can be started only after Activities C and D are completed. The network shown is visually more effective than the table when representing the relationships between the activities.

3.2.3 Late Start Schedule

The Late Start Schedule also known as the backward pass is the backward calculation of the durations to complete each activity of the project without delaying the project. For example, If the delivery of a project is promised for week 58, the other activities should be completed before week 58. Table 3 below shows the calculation of the Late Start Schedule.

Table 3. Late Start Schedule, as depicted by Olson (2020, p. 28)

Activity		Late Finish	Late Start	
E	Implement system	58	58 - 5 = 53	Releases C and D
D	Develop training	53	53 - 20 = 33	
C	Build system	53	53 - 40 = 13	With D, releases B
B	Bid job and complete contract	MIN (13,33)	13 - 1 = 12	Releases A
A	Estimate cost to complete Project	12	12 - 12 = 0	

As shown in Table 3 above, the calculation is done in reverse. The completion week for Activity E is 58, so the Late Finish for E is 58, and Activity E takes 5 weeks to complete. The Late Start for E, therefore, is 53. With the same principle, the Late Start is 33 and 13 for D and C respectively. At this stage, Activity B is released with the completion of C and D, therefore, the Late Finish for B is the minimum of those values and is 13. The Late Start for B and A is calculated at 12 and 0.

The Late Start Schedule is different from Early Start Schedule in the sense that the project can start late but still finish on time. This scheduling technique gives a magnificent benefit on storage of the inventory and cash freeze.

3.2.4 Slack and Slack Calculations

Slack also known as a float is the extra time available to finish the activity. It is calculated by subtracting Late Finish from Early Finish or Late Start from an Early Start. If the difference is zero, the activities are called critical activities. These activities cannot be late without delaying the project. However, activities with Slack are flexible with start and finish as shown in Table 4 below.

Table 4. Slack calculations, as depicted by (Olson, 2020, p. 29)

Activity	Early start	Early finish	Late start	Late finish	Slack	
A Estimate cost to complete project	0	12	0	12	0	Critical
B Bid job and complete contract	12	13	12	13	0	Critical
C Build system	13	53	13	53	0	Critical
D Develop training	13	33	33	53	20	
E Implement system	53	58	53	58	0	Critical

Table 4, above shows the combined calculation of Early Start and Late Start Schedules. Activities A, B, C, and E are critical activities and if these are delayed, the whole project will be delayed. Activity, D has however some flexibility to start and finish as it has a slack of 20 weeks.

For better visual presentation, the above information can be put together with a network chart which is shown below in Figure 10.

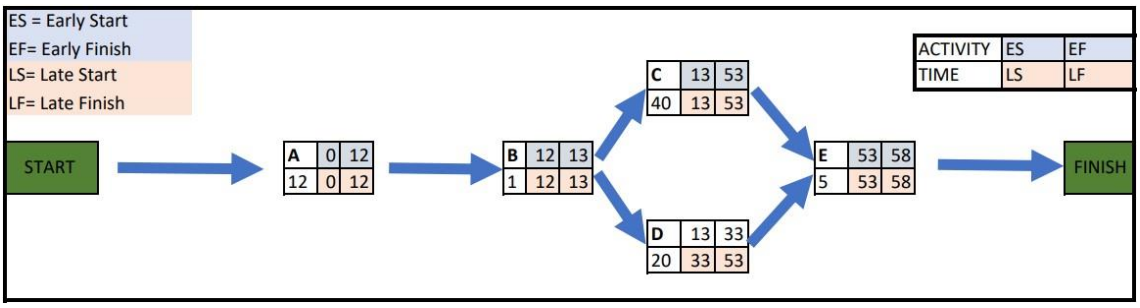

Figure 10. Slack calculations, as depicted by (Anderson, et al., 2015)

The relationship between the terms is given below:

- Early Finish (EF) = Early Start (ES) + TIME
- Late Start (LS) = Late Finish (LF) – TIME

- Slack = Late Start (LS) – Early Start (ES) or Late Finish (LF) – Early Finish (EF)

Figure 10 gives a visual presentation of the activities and their relationship. It also shows how the Early Start Schedule and Late Start Schedule can be put together to calculate Slack.

Referring to the figure above, activity A does not have any predecessors, so A is the first activity. The duration A takes to finish is 12 weeks and it releases B. B takes one week to finish. Thus, the earliest B can start is 12 and it can finish earliest is 13. C and D are released by the completion of B. Thus, the earliest C and D can start is 13. C takes 40 weeks to finish. Therefore, the Early Finish for C is 53. On the other hand, D takes 20 weeks to finish, and Early Finish for D is 33. C and D release E and Early Start for E is 52 and it takes 5 weeks to finish to give an Early Finish of 58. This gives a total duration of 58 weeks to finish a project.

For Late Start Schedule, the calculation is done backward. The last activity before the finish to complete is E. Thus, E must be finished by week 58 to finish the project on time. Therefore, LF for E is 58 and the latest E can start is week 53 as it takes 5 weeks to finish. Now, activities C and D must be completed on week 53. Therefore, LF for both is 53. D takes 20 weeks to finish and it gives the value of 33 as LS. However, C takes 40 weeks to finish and the LS for C is 13. Activity B must be finished to start C and D, thus, the minimum duration is taken as LF time for B and is 13. The LS for B is 12 as it takes 1 week to finish. Finally, LF for A is 12 and by subtracting 12 weeks to finish activity A, we get the value of 0 as LS.

The above figure makes it easier to calculate Slack. The slack for each activity is calculated by subtracting Early Finish from Late Finish or Early Start from Late Start. The result is the same. For activity A, the slack is zero. It is the same for B, C, and E and these are the critical activities in the project. However, LS-ES is 20

for activity D. There is a slack of 20 weeks for activity D and is not a critical activity as it gives the flexibility of 20 weeks duration to postpone the activity.

Finding out which one is the critical activity in a project is very important in project management. The activity with Slack also gives the flexibility to manage the resources as well.

3.2.5 Gantt Chart (Activity Vs Time)

The Gantt Chart is simply a graph with two components: Time on the X-axis and Activity on Y-axis. When activities are divided into many, Gantt Chart gives the visual output to plan how the activities should be started, when they should be finished, and the current status with the calendar. Gantt Chart is created with values from the early start schedule as shown in Figure 11.

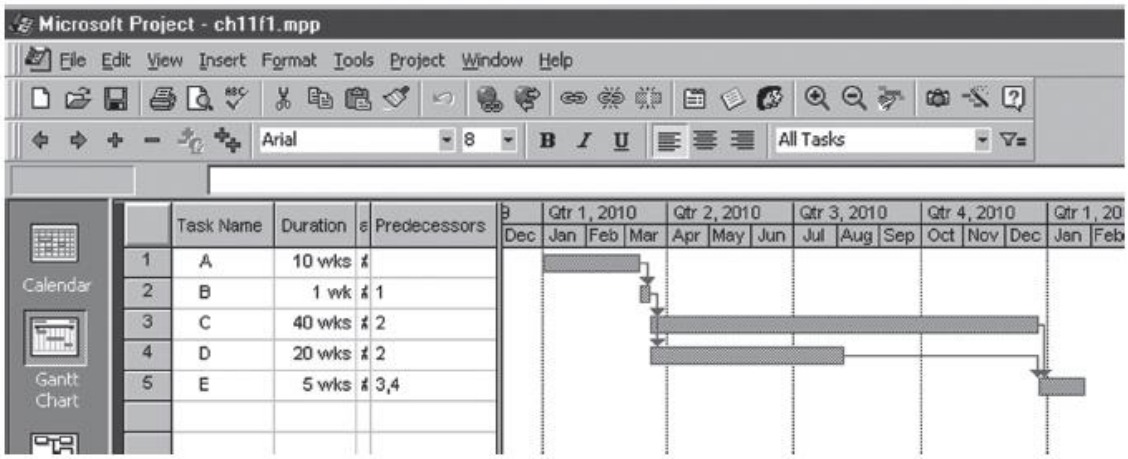

Figure 11. Gantt chart from Microsoft Project, as depicted by Olson (2020, p. 30)

The example shown in Figure 11, plots the activities from A to E with the duration to finish the individual activities. This also maintains the relationships between the activities with the respective predecessors. The Gantt Chart starts with Activity A. Activities C and D are released after the completion of Activity B and are started parallel. Activity E is the last activity in the project and the whole project is plotted with the calendar.

Gantt chart is a very useful, and thus, a widely used tool for a project manager. The chart gives a great visual representation of the activities.

3.2.6 Resource Levelling and Smoothing

Referring to Olson (2020, p. 32), Resource Levelling and Smoothing are required in project management because Critical Path Method with Early Start Schedule assumes that the project has unlimited resources. For example, if an activity needs a specialist for two parallel activities, one must be delayed. Resource Levelling focuses on not overlapping those activities which need the same specialists. The usual outcome of resource leveling is a longer project completion time if slacks do not recover. Figure 12 below depicts the network for leveling project.

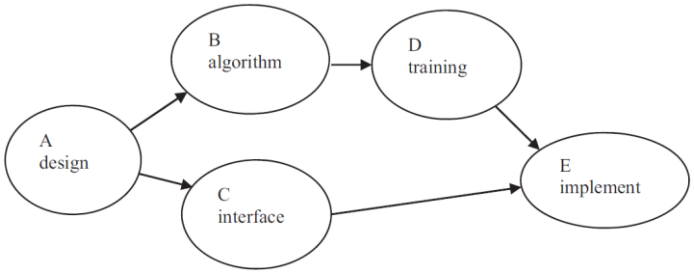

Figure 12. Network for leveling project, as depicted by Olson (2020, p. 32)

The network shown above (Figure 12) has 5 activities in total with A at the start and E at the finish. Completion of activity A releases B and C. Activity B releases D and completion of both C and D releases E.

Table 5 below depicts the ESS, LSS, and slack calculation for a project with a shared resource of a specialist.

Table 5. Leveling project data, as depicted by Olson (2020, p. 32)

Activity	Duration (weeks)	Pred	Early start	Early finish	Late start	Late finish	Slack	Resource
A Design	3	None	0	3	0	3	0	
B Algorithm	5	A	3	8	3	8	0	Specialist
C Interface	6	A	3	9	6	12	3	Specialist
D Training	4	B	8	12	8	12	0	
E Implement	3	C,D	12	15	12	15	0	

Table 5 shows the duration to finish each activity with C being the longest with 6 weeks. Activities A, B, D, and E are critical activities as they have 0 slack. Activity C has a slack value of 3 but shares the needed specialist with activity B.

Figure 13 below shows the schedule for a project with a CPM model with a project duration of 15 weeks.

		W	E	E	K	S										
Activity	Duration	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A design	3 w															
B algorithm	5 w															
C interface	6 w										s	s	s			
D training	4 w															
E implement	3 w															
	Scheduled															
	Slack	s														
	Critical															

Figure 13. Schedule for Leveling Project, as depicted by Olson (2020, p. 33)

As shown in Figure 13, the problem with this schedule is that activities B and C start at the same time with the requirement of the same specialist. This is not possible in reality, either B or C must be delayed in accomplishing the project if the company does not want to hire more specialists and it is the case in most companies.

To deal with this kind of situation, the longest activity which is critical must be completed first which shares the common resources. This means that Activity C must be started before Activity B.

Figure 14 below depicts the Leveled Project to fix the issues of sharing a specialist.

		W	E	E	K	S															
Activity	Duration	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
A design	3 w																					
B algorithm	5 w										x	x	x	x	x							
C interface	6 w				x	x	x	x	x	x												
D training	4 w																					
E implement	3 w																					
	Specialist	x																				

Figure 14. Leveled Project, as depicted by Olson (2020, p. 34)

Figure 14 shows the leveled project after activity B has been delayed. Activity C has a longer duration compared to activity B, thus chosen to start first when sharing common resources. The slack for activity C (figure 14) has now been utilized and therefore all activities are now critical (activity B releases D and cannot be started at the same time). The finish of the project is week 21.

To check if the longest activities are always best to start first, activity B is started first and C is delayed in the upcoming schedule in Figure 15.

		W	E	E	K	S												
Activity	Duration	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A design	3 w																	
B algorithm	5 w				x	x	x	x	x									
C interface	6 w									x	x	x	x	x	x			
D training	4 w													s	s			
E implement	3 w																	
	Specialist	x																

Figure 15. Alternative Leveled Project, as depicted by Olson (2020, p. 34)

As shown in Figure 15, the alternative approach to handling the scarcity of resources, activity B is started first and C follows. Above figure 16 shows that B starts at 4 and ends at 8. C starts immediately and ends at 14. However, activity D can be started parallel to C. Activity C takes 6 weeks and D takes 4, thus, we have a slack of 2 weeks for activity D in this scenario. The finishing time with this approach is week 17.

The alternative approach here is the winner among the two approaches as it saves 4 weeks while finishing the whole project. The Leveling Project concludes that different schedules can be made to spread the scarcity of resources. However, there is no clear answer to which approach is the best in all scenarios but trying out different approaches with their activities relationship network and finding out which approach makes the project shortest.

3.2.7 Resource Smoothing

The resource smoothing technique is used for distributing the workload equally in a multi-project environment. This concentrates on extending or compressing activity duration so that the workload stays at a level. Below is the figure which shows a network of a company with 3 identical projects at the same time.

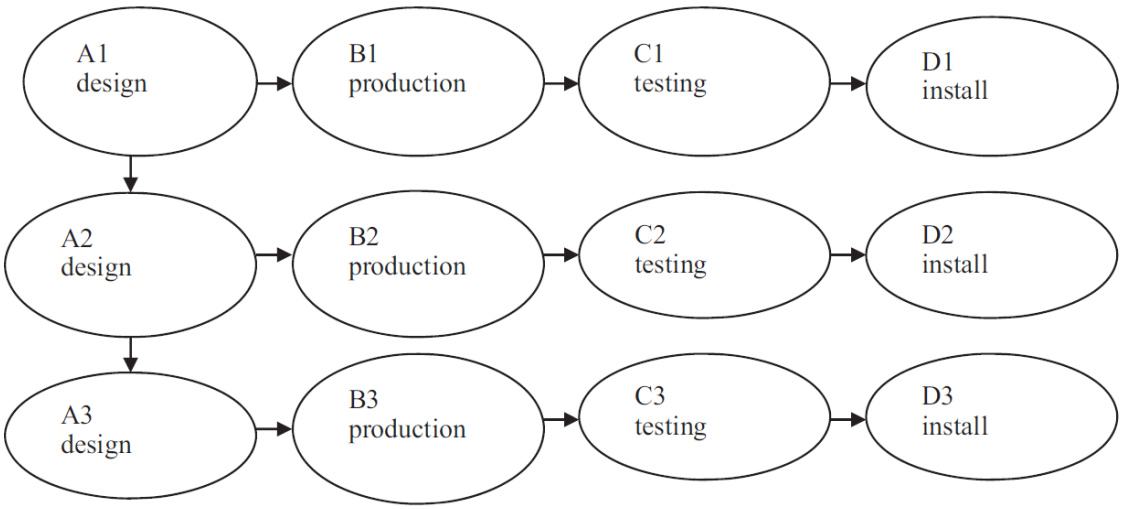

Figure 16. Network for resource smoothing, as depicted by Olson (2020, p. 35)

The above figure shows that each project has a design, production, testing, and installation phase. Each phase is related to the finishing of its predecessor being A (Design) as the first activity. For a wider experiment, the duration for the same activities in different projects is considered different.

Figure 17 below shows the Gantt Chart created in a multiple-project environment with an immediate start of production, testing, and installation tasks after designing is completed.

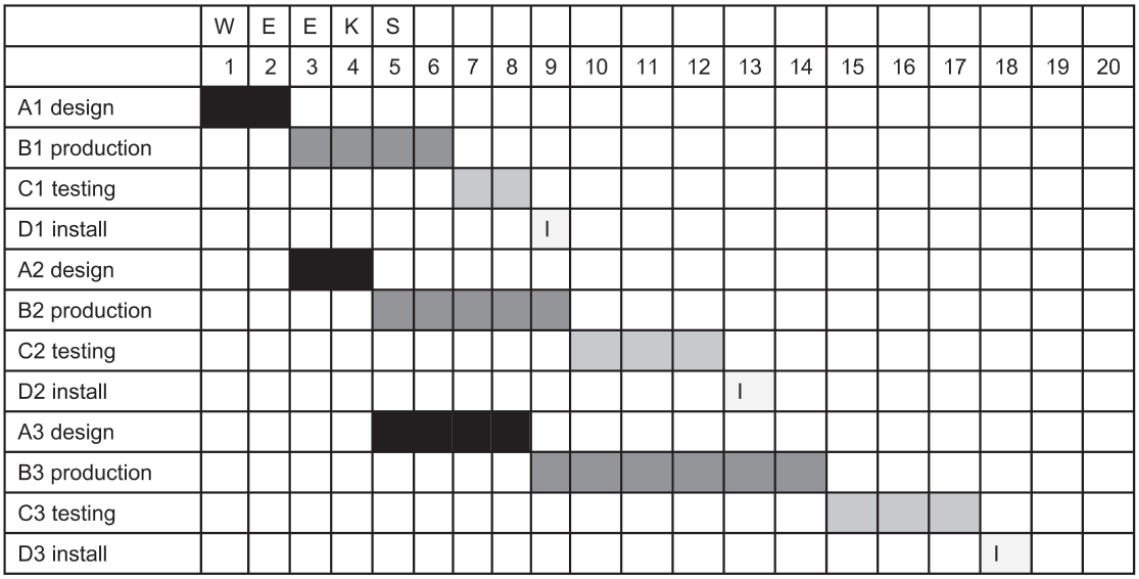

Figure 17. Gantt chart for multiple projects, as depicted by Olson (2020, p. 36)

Figure 17 shows that the design crew workloads for projects 1,2 and 3 are evenly distributed. It starts from week 1 and finishes at 8. However, the production crew has a peak time on weeks 5 and 6 as the schedule overlaps. The production crew has double work to do and that might be stressful for the crew and is not ideal. For the testing crew, there is a gap of 1 and 2 weeks respectively between projects. A similar situation is true for the installation crew is the widest gap in their schedule.

To resolve this situation, two choices can be made: renting/ adding a second crew to complete the activities to complete the project on time or rescheduling so that the workload stays smooth but the project finishes late.

Figure 18 depicts resource smoothing with the second production crew added.

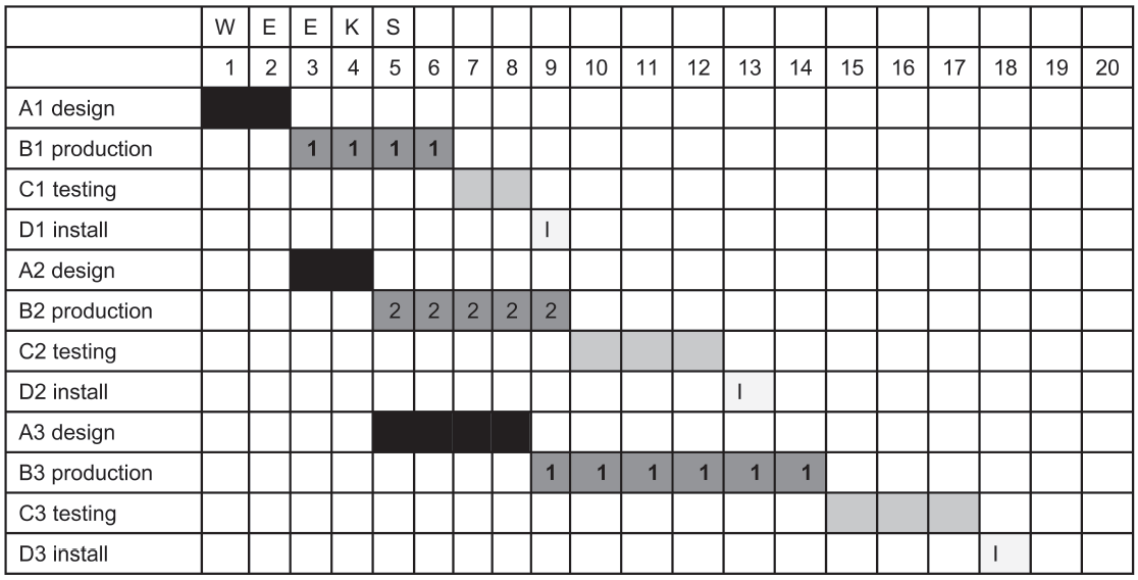

Figure 18. Schedule with the second production crew, as depicted by Olson (2020, p. 38)

Adding the second crew for production is one way to smooth the workload. As shown above, in Figure 18, one production crew works on 1st project for 4 weeks but the second production crew is added to complete the 2nd project activities. The first production crew is again utilized in the 3rd project. Here, we can see that the 1st production crew has 2 weeks of slack before they join the 3rd project work. The crew can be used in other works if the management finds useful work to do. Otherwise, this is not ideal for a company. The problem continues for the testing and installation crew as they have a big gap to fulfill. The benefit of adding the second crew for production is that the schedule is kept and no projects are late.

Figure 19 depicts the smoothed schedule of using only one production crew.

	W	E	E	K	S															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A1 design																				
B1 production			1	1	1	1														
C1 testing							x	x												
D1 install									x											
A2 design																				
B2 production							2	2	2	2	2									
C2 testing												x	x	x						
D2 install															x					
A3 design																				
B3 production												1	1	1	1	1	1			
C3 testing																		x	x	x
D3 install																				

Figure 19. Smoothed (delayed) schedule, as depicted by Olson (2020, p. 39)

The smoothed schedule (Figure 19) shows the result of using one production crew only for the completion of the whole project. The production crew starts the work right after the design is completed in 1st project but it is not possible if we have the original condition of having only one crew. This means that only after the production crew is done with the 1st project they can move to the 2nd project. The same continues to the 3rd project. To maintain this, the schedule is stretched to week 21 to do the final installation work for the 3rd project and thus, the final project is delayed.

Below is the summary for Resource Smoothing:

1. Obtaining more resources is useful if the management can get more profitable work for the organization.
2. The schedule stays true with the addition of resources.
3. Utilizing available resources is beneficial if the work is constant for the company.
4. A delayed schedule enlarges the project completion time and may cause penalties for the organization.

5. A delayed schedule widens the gap for some crews as in the given example above for testing and installation crews.

3.3 Evaluation and Closing Phase

The evaluation and closing phase is the final phase of project management. In this phase, tools and methods are used to evaluate how the project has progressed. This section discusses project crashing to decide whether some different methods can be used instead of another to save budget or to stay on schedule. It also focuses on S-Curves for analysis purposes.

3.3.1 Project Crashing

Project Crashing, also called cost-time trade-off, in project management is the way to cut project completion time with costs involved in it. Whether the costs involved are due to renting more crews for production, purchasing the same materials from a more expensive source if the delivery is faster than the regular supplier with a longer delivery time, or choosing a faster delivery medium to save the project finishing duration. The main advantage of Project Crashing is faster project completion so that more work can be obtained by the company. (Olson, 2020, p. 49).

The critical path is first discovered with the network diagram. Then, the crashing options with the costs per day or week are calculated. The cheapest activity is almost always first crashed to maintain the priority of making a profit. Table 6 below depicts the example of Project Crashing.

Table 6. Crashing Project, as depicted by Olson (2020, p. 52)

Activity	Duration (days)	Pred	Early start	Early finish	Late start	Late finish	Slack	Crash
A Develop layout	19	none	0	19	0	19	0	
B Obtain permits	5	A	19	24	19	24	0	10,000/day 1 max
C Facility work	30	B	24	54	24	54	0	3,000/day 2 max
D Inspect cabling	2	C	54	56	54	56	0	
E Install remote line	53	None	0	53	0	54	0	5,000/day 12 max
F Test lines	2	E	53	55	54	56	0	
G Test system	2	D, F	56	58	56	58	0	

The table above shows the relationship between project activities, their relationship, slack, and crashing options. Activity B, C, and E can be crashed with expenses of 10000, 3000, and 5000 per day respectively. Those crashings also have limitations maximum of 1, 2, and 12 days for B, C, and E respectively.

A network gives a clearer view of the relationship between activities presented above in the table. Figure 20 below depicts the network for the line project.

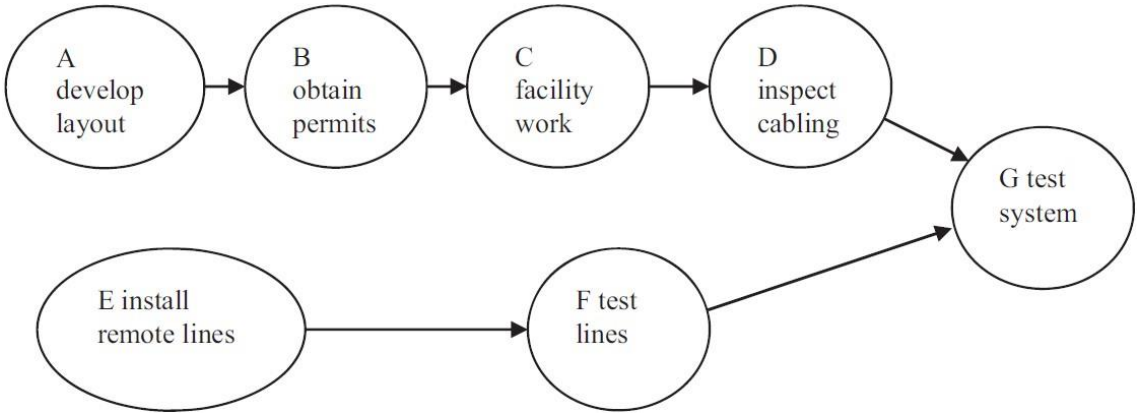

Figure 20. Network for line project, as depicted by Olson (2020, p. 52)

The above network shows the relationship between activities E, F, and G as the shortest (57 days) but A, B, C, D, and G are the critical activities giving a total of 58 days for project completion.

Figure 21 depicts the schedule for the crashing example where Activity B and C are possible crashing options.

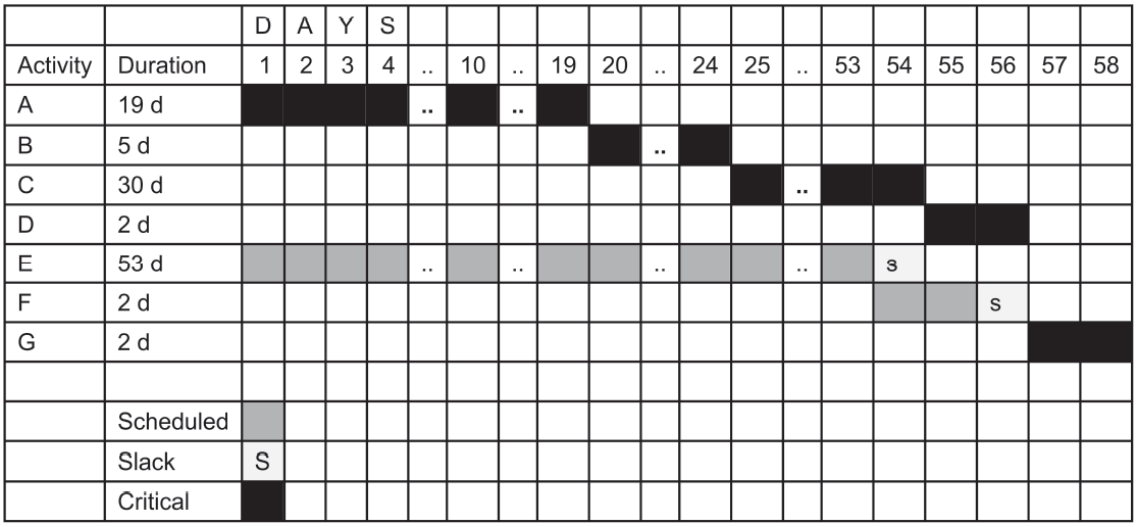

Figure 21. Schedule for crashing example, as depicted by Ohlson (2020, p. 53)

Figure 21 shows the schedule of a project. The total time to finish is 58 days and either activity E or F can have a slack.

The rule of project crashing is only a member of the critical path can be crashed. As B and C are on the critical path, the cheapest option is used first. Activity C has crashing costs of 3000 per day and is more affordable than B (10000 per day). Table 7 below depicts the project crashing with activity C crashing for 1 day to see the effects on the critical path.

Table 7. Crashing Project after crashing C, as depicted by Ohlson (2020, p. 53)

Activity	Duration (days)	Pred	Early start	Early finish	Late start	Late finish	Slack	Crash
A Develop layout	19	none	0	19	0	19	0	
B Obtain permits	5	A	19	24	19	24	0	10,000/day 1 max
C Facility work	**29**	B	24	53	24	53	0	3,000/day 1 max
D Inspect cabling	2	C	53	55	53	55	0	
E Install remote lines	53	None	0	53	0	53	0	5,000/day 12 max
F Test lines	2	E	53	55	53	55	0	
G Test system	2	D, F	55	57	55	57	0	

As shown in Table 7, crashing of C is used for 1 day. Compared to starting phase (shown in Table 6), the only difference is the duration of activity C (29 days) as crashing for 1 day is used. Here, the critical path is 57 days, the same as the second path option (E-F-G). This makes both paths as the critical paths after crashing.

The schedule is created with a shorter duration (29 days) for Activity C which is depicted in Figure 22 below.

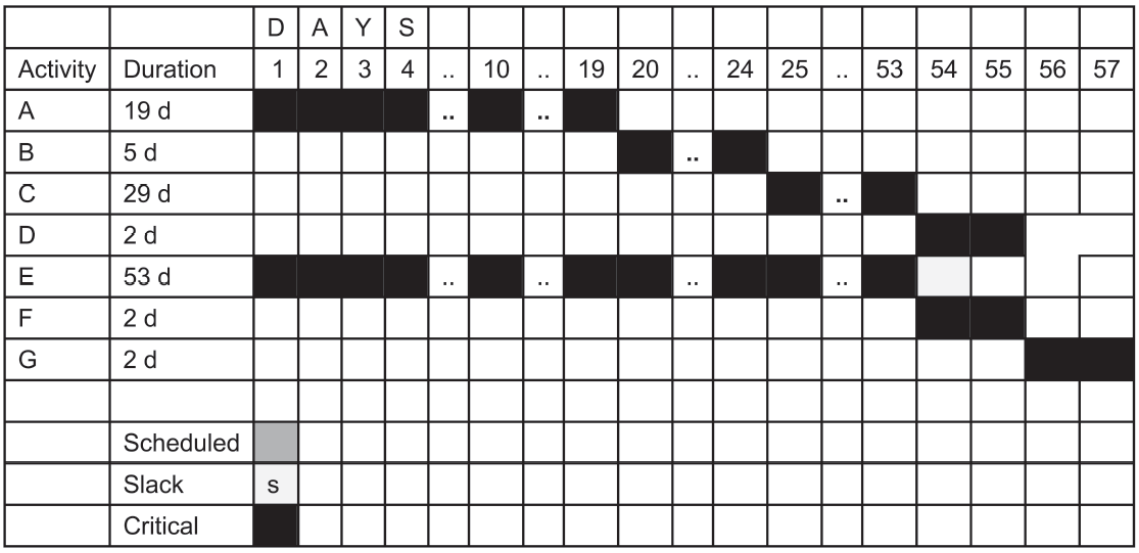

Figure 22. Schedule after crashing C, as depicted by Ohlson (2020, p. 54)

As shown in Figure 22, the schedule after crashing C is presented above with both paths A-B-C-D-G and E-F-G being critical. This opens up a path for E as it is also a critical activity and can be crashed with a cost of 5000 per day and can be used for a maximum of 12 days.

The next step is to Crash C again and E for 1 day to keep both critical paths the same. Table 8 below depicts the project after crashing C and E.

Table 8. Crashing Project after crashing C and E, as depicted by Ohlson (2020, p. 53)

Activity	Duration (days)	Pred	Early start	Early finish	Late start	Late finish	Slack	Crash
A Develop layout	19	none	0	19	0	19	0	
B Obtain permits	5	A	19	24	19	24	0	10,000/day 1 max
C Facility work	28	B	24	52	24	52	0	
D Inspect cabling	2	C	52	54	52	54	0	
E Install remote line	52	None	0	52	0	52	0	5,000/day 11 max
F Test lines	2	E	52	54	52	54	0	
G Test system	2	D, F	54	56	54	56	0	

If E is crashed to cut the critical path to 56 days, activity C should be crashed again to keep both critical path duration the same. Here, the total cost for crashing C, E, and C again is 11000 which is shown in Table 8.

Further crashing is done to shorter the duration of the project. Table 9 below shows the crashing with all activities still being critical.

Table 9. Crashing Project after crashing B, C, and E twice, as depicted by Ohlson (2020, p. 55)

Activity	Duration (days)	Pred	Early start	Early finish	Late start	Late finish	Slack	Crash
A Develop layout	19	None	0	19	0	19	0	
B Obtain permits	**4**	A	19	23	19	23	0	
C Facility work	**28**	B	23	51	23	51	0	
D Inspect cabling	2	C	51	53	51	53	0	
E Install remote line	**51**	None	0	51	0	51	0	5,000/day 10 max
F Test lines	2	E	51	53	51	53	0	
G Test system	2	D, F	53	55	53	55	0	

As shown in Table 9, the total available days for Crashing are now utilized for B and C. The project finishing time is cut to 55 days. Both paths are critical as they should be at the moment. The total costs involved is 26000.

The original schedule is compared to new schedules after crashings. The expenditure is also shown in Table 10 below.

Table 10. Crashing options, as depicted by Ohlson (2020, p. 55)

Original schedule	58 days	No extra expenditure ($)
Crash C 1 day	57 days	3,000 extra cost
Crash C 2 days, E 1 day	56 days	11,000 extra cost
Crash B 1 day, C 2 days, E 2 days	55 days	26,000 extra cost

Table 10 shows the crashing options and their costs. Option 1 with crash C only for 1 day gives 3000 extra costs. Crash C for 2 days and E for 1 day to maintain the critical path cuts out 2 days in total but costs 11000 extra for a company. The third option is the most expensive of all with 26000 extra costs to save a total of 3 days.

Project Crashing gives options for cutting the project duration short as discussed above. However, it comes with a cost. If the costs are too big compared to the time savings in days and do not bring any benefits to the company, then it does not make any sense to use those.

Project Crashing is an important tool in the evaluation and closing phase of a project to plan the possible outcomes. This tool can also be used in the execution phase parallelly with the project running. However, this brings sudden schedule changes and it can be complex. Therefore, it is advised to use it in the Evaluation and Closing phase, document it and use it in the early execution phase of the next project with all the options available.

3.3.2 Costs Versus Time S-Curve

Costs Vs Time S-Curve is very convenient in an industrial company where materials are bought from outside and laborers are employed to manufacture a product. The total costs are tracked, and a curve is plotted against the time to get the S-Curve. It can be also used to track the cash flow of the project. Figure 23 below depicts an example of the Costs Vs Time S-Curve.

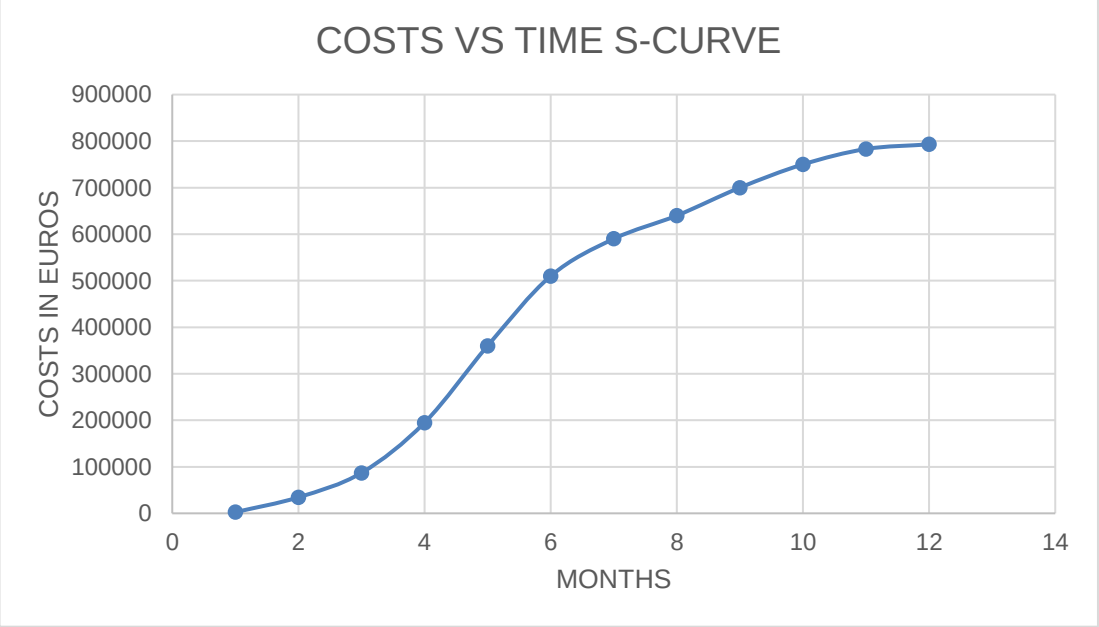

Figure 23. Costs vs Time S-Curve

As shown in Figure 23, the time is represented on the x-axis, and the total costs are on the y-axis. The number of data collected on a specific day (end of the week or month) is chosen freely by the project manager as per need. Close tracking of the project is possible with more data inserted.

3.3.3 Man-Hours Versus Time S-Curve

This S-Curve is beneficial to track the labor. An example of the Man-hours Versus Time S-Curve is depicted in Figure 24 below.

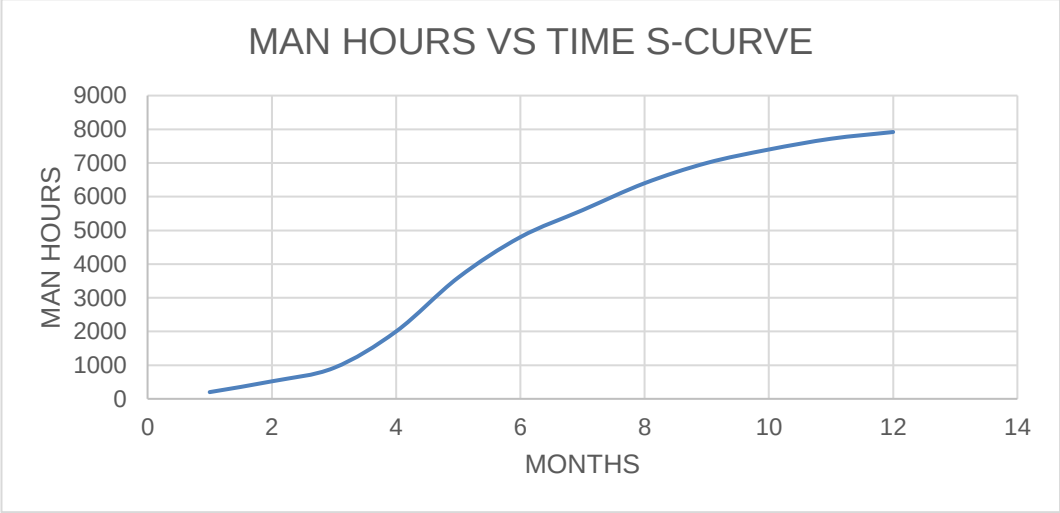

Figure 24. Man-hours Vs Time

As shown in Figure 24, Man-Hours in the y-axis is plotted against the time in the x-axis. Man-hours are the total hours spent by the total manpower to complete the project.

3.4 Conceptual Framework

The methods and tools to manage projects are described in the previous sections with the help of relevant literature. Figure 25 below gives the visual presentation of three important phases and methods and tools as important variables.

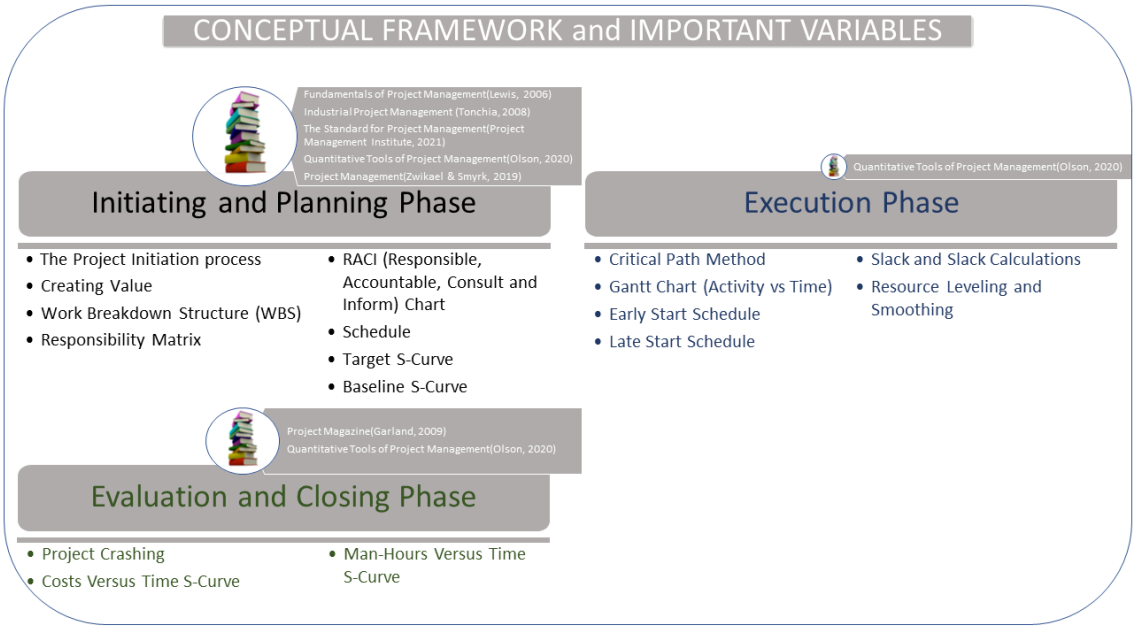

Figure 25. Conceptual Framework

As shown in Figure 25, in the Initiating and Planning Phase, the project is evaluated through the process of whether it should be taken into consideration. If the project is adopted, the project is investigated more to find out the value creation. The WBS is used to split tasks into subtasks and micro tasks if needed. The next process is to make a responsibility matrix and make the project members aware of it. The RACI chart is then created with scheduling followed after. The S-Curve tools are then used to plan further how the upcoming project should go.

The second stage is the execution phase. The work is started with CPM which utilizes an early start schedule. A Gantt chart gives a visual representation of work activities and their duration. Resource leveling and smoothing are done to manage the resources and the duration.

The final stage of the Evaluation and Closing Phase includes Project Crashing to check if the project duration could be cut short to save project completion time. The remaining S-Curves such as Costs and Man Hours versus Time are used to analyze the project further.

The Conceptual Framework created in this section is used to create a CSA interview template to identify the current strengths and weaknesses of the current methods and tools to manage customer projects. The findings from the CSA are then combined with the Conceptual Framework to build the initial proposal for the case company.

4 Current State Analysis

This section explores the current state of project management at the case company. The section starts with a brief overview and then proceeds to the practices used to manage customer projects. It then continues describing the different phases of the projects with the help of the data plan stated in section 2 and the findings are dissected to obtain the current strengths and weaknesses.

4.1 Overview of the Current State Analysis

This stage was carried out according to the data plan in Section 2. The interviewees were selected according to their job and the title of the employees in the case organization. The informal talk was mostly conducted in the coffee room and the lunch restaurant. The employees were first asked if they were interested to talk more about the methods and tools to manage customer projects. The room and time slot were agreed upon for the interview with the permission of a company representative. The interviews lasted about an average of 35 minutes.

The case company had many projects running parallel at the same time. One project was given to one employee from the design department and it made them a project manager for that project. All the responsibilities of that project lay with the project manager starting from 3D designs to documentation. Timetables management and resource allocation stayed at the top of their priority. The completion of these projects on time was therefore also directly linked to the case company's success and future. Thus, project managers paid direct interest to the objective when mentioning the objective of this thesis "To propose an action plan to manage customer projects".

Project managers in the Design and Engineering department were involved as most of them had to manage customer projects with the available methods and tools. Therefore, the project managers were directly interested in it. The project

members, the design director, the managers of different departments, and the CEO are also the stakeholders in this situation.

The interviewees were asked about the current project management methods and tools. Firstly, the questions were about the pros and cons of the current project management. The project steps were shown and asked in detail about the process later in the interview. The tools currently in use to divide activities and responsibilities, and manage timetables and resources were also asked about as mentioned in the Appendices. The complete set of interview questions can be found in the Appendices of this thesis.

Figure 26 below shows the situation of the customer projects in the case company and is created with the data found from the database of the case company. The graph shows the year on the x-axis and the project delayed on the y-axis. The secondary axis on the right is used for the dotted line to represent late delivery in weeks. The data is collected from the year 2017 to 2022 making a total of 6 years and it shows the total number of projects completed in the blue bar. The light grey bar represents the number of delayed projects for that particular year. Figure 26 below depicts customer projects and delays in the case company.

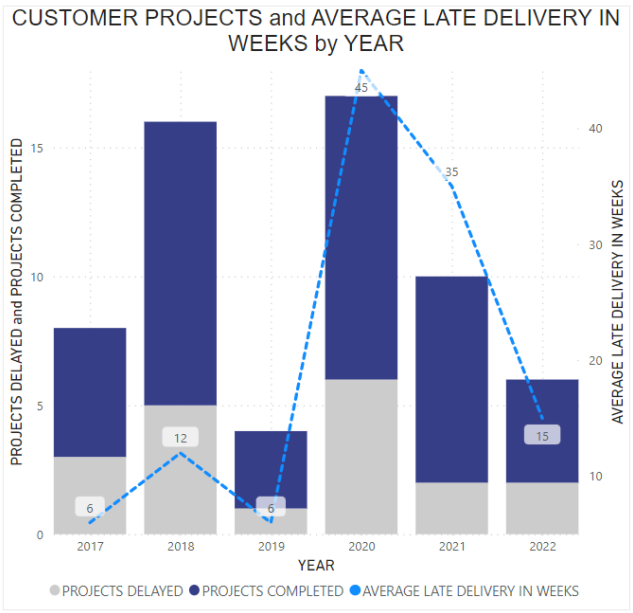

Figure 26. Customer Projects and delays

Figure 26 above shows a total of 8 projects were completed in 2017 and 3 of them were late for delivery. On average, projects were delayed for 6 weeks in 2017. The highest number of projects completed was in 2020 with 16 projects completed but 6 of those were late and the average delayed duration was 45 weeks.

The reasons for the delayed projects could be because of the delay from the customer to provide detailed specifications for designing purposes or because of the internal issues of the case company. The reasons, however, were not found in the database.

The importance of a proper customer project management system is highlighted in Figure 26 above. The delayed projects cost money to the organization. It is a puzzle to solve for the management if it is not able to utilize its resources efficiently. The proper concept to manage customer projects includes creating WBS, making efficient timetables, and managing resources with leveling and smoothing, among others.

4.2 Description and Illustration of the Current Methods and Tools to Manage Projects

A detailed process map was found in the documents from the server. When asked about it in the interview, most of the informants mentioned that it is not in use. Some spoke about it being too deep and not for every project manager. Only one mentioned that it is in use and the informant is a Design Director of the department.

The Project template was also found on the server. The purpose of the template was to give basic information about the project but served more like a notebook for that particular project. The production items to be corrected, development ideas, and also tracking of the project were included in the template. It also mentioned the responsible person for the project with other project-related financial information.

The third document found on the server was the customer project steps. Project steps created in 2010 were found in the old documents. However, it was in Finnish and needed to be translated. The translation was carried out informally with an informant and the writer of this thesis. This concept mentioned the steps starting from initiating a project, creating a framework, booking resources, starting the inspection, and getting into the real work of designing and production. The step continued to prototype creation, batch manufacturing, and ending the project. These customer project steps, as depicted in Figure 27 below were shown to the informants and talked about in detail.

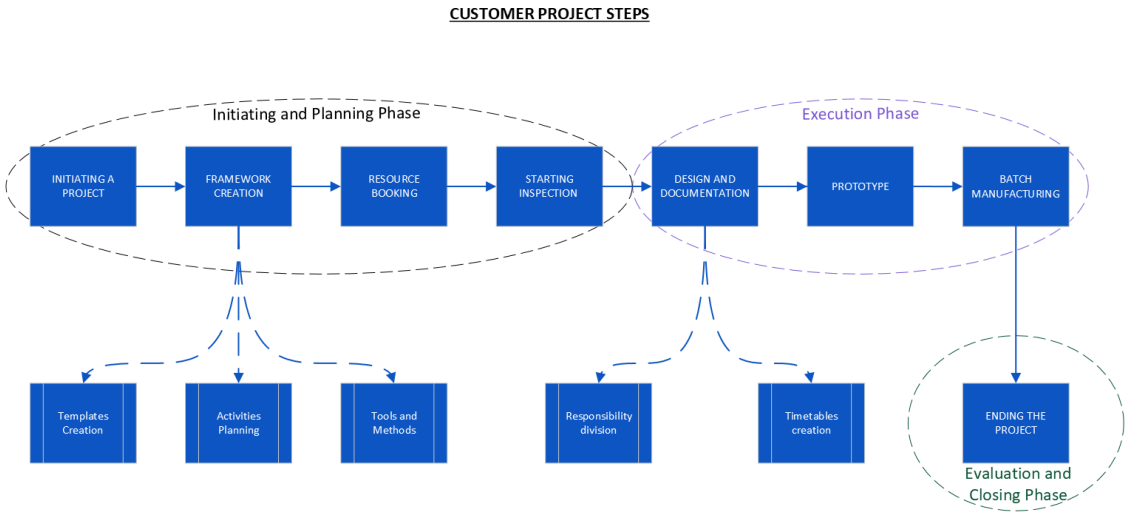

Figure 27. Customer project steps in the Case Company

The current concept to manage customer projects (Figure 27) was later further divided into three different phases: Initiating phase, the Execution phase, and the closing phase. The processes were followed one after another, were very clear, and were dependent on the predecessor. For example, framework creation could not be done without initiating a project. Also, project initiation was done only after the sales work is completed which is not shown in the customer steps above. The project continued step by step as shown in the figure until the project ended with the after-sales team delivering and assembling the project.

The third step of the initiation phase was resource booking. The informants stressed the importance of resource booking and mentioned that no tools and methods are available at the moment to complete this step successfully. However, the production department used the resources in the order according to the priority and the documentation of the processes was unknown to the informants as they belonged to the different departments. It seemed that better communication was also needed in the case company.

The job of the informants was Designing and Documentation as they belong to the design department. This step also had the issue of no planning tools being available while handling the job. The timetables were not built by the supervisor but were given the delivery date of the project. The starting date of the project was calculated by reducing the duration needed for the production work. This was done individually by all project managers in Microsoft Excel. The current way to keep timetables was to make an Excel spreadsheet and collect the important dates individually for the important tasks. The important tasks had no relation between each other and the dates. If the earlier task is late, all the manual work is needed to fix the next activity date in Excel.

The activities inside the Designing and Documentation step were on a surface level. The activities were not broken down into small subactivities because the work breakdown structure was not in use.

When a new project was initiated, the head of the engineering department selected the project manager. The project manager was responsible for 3D design and documentation work. The delivery date of the project determined the workload of the project. Many projects were running at the same time. It means the resources were already divided. If the work progress was not as per expectation due to holidays, sickness, or something else, the stress level for the project manager rose as they did not know if somebody else could help. For example, the first project was utilizing 3 personnel including a project manager. The second project had nobody else than the project manager and needed help. Due to the reason that no timetables or resource management were done, the

project manager was not sure if help is provided. This created confusion. Also, the timetable created (if created at all) was kept private by the project manager. Therefore, project managers had no clear view of the projects and resources available.

As the case company was growing bigger, the experts in the Design and Engineering, Management, Sales, Procurement, and Production departments were increasing. The bigger team needed proper management especially when multiple projects were running parallel at the same time. More projects did not automatically mean a better future for a company if efficiency was not managed. An action plan to manage a project was very important because it would give clear instructions to the project managers, save time, and reduce stress. Communication also would get better when activities are running smoothly. On the contrary, if the issues of the project management methods and tools were not solved, the projects could be late with no proper timetables, activities could be overlapped with common specialists, resources could be overbooked or used inefficiently for multiple projects at the same time, and production crews could end up with the higher workload. This would not be ideal for any company as it would increase uncertainty, stress, and delayed projects. The relationship with customers could be on the edge because of the late delivery of products, customers could start to lose trust in the case company, and the employees could be stressed, unmotivated, and could start to think the easy way out thinking to move on to the next company. These issues were directly threatening the future of the case company if not solved on time.

The answer of the informants for some questions varied and some were somehow similar. For example, when asked about the project management process, one informant said that the detailed project process was available and was in use. However, others did not know about it at all. Here is what one informant said while interviewing about the project management process.

> “I think the detailed version (of the project management process) is a work in progress, we haven’t really used that much” Data 1: Informant 3

The use of tools for timetables and activity tracking in project management was asked in the interviews with the informants. Below are some examples of what informants mentioned.

> “I don’t use it (timetables and activity) but if I have many projects at the same time, I make timetables in Excel myself. Basically, It would be good to have tracking for what we are doing and what we should be doing.” Data 1: Informant 2

> “Excel is used, we can use other project’s timetables and change it for the new one” Data 1: Informant 3

When asked about resource booking and management, the answers were very similar. Here are some answers from the informants.

> “We don’t have anything for resource booking.” Data 1: Informant 1

> “Good question (chortle laugh). Basically, if there are double bookings, I do not bother others there (in the electrical lab)” Data 1: Informant 2

> “We don’t know about it. The supervisor books the resources” Data 1: Informant 3

The CSA interview also covered the responsibility topic in project management in the case organization. In this matter, almost all project managers had the same view that the project manager is responsible for all the tasks within the project and is somehow clear. The informants had no clues about the usage of the responsibility matrix in a project to increase communication and overview.

The views expressed by the informants regarding timetables reveal that the model in Microsoft Excel for timetables creation was available to everyone. Some project managers used it as they needed it. Some did not even consider using it because the available model was very manual work to update and was not efficient. Surprisingly, some project managers seemed to complete the project even without using it. The interviewees rarely mentioned about Gantt Chart. It indicated that the engineering department was unknown of how the timetables and activity could be tracked easily and automatically without manually updating the Excel template.

The tracking of the tasks was also done with the use of the same timetable template. Otherwise, no other tools were available at that time. This is a common issue in project management where no tasks are divided into subtasks. The importance of timetables and activity tracking was not talked about enough in the case company which would help to increase efficiency at work.

Regarding resource management tools, the project managers seemed to have understood that it was needed only for the supervisors and was not that necessary. This showed that the case company also needed to increase the special project management training for project managers.

4.3 Strengths of Current Methods and Tools to Manage Projects

The interview conducted revealed a list of strengths in the case company. The most noticeable was the freedom to make your order of the activities. Since there was no activity order regarding the timetables, project managers can choose which work to start. Managers could plan the project so that the order of the activities suits their timetables. For example, if a project consisted of many different activities and the activities had no predecessor, project managers were free to choose the activity to their liking. It was all about how the project activities suit individual ways of working. This gave a big advantage of freedom at work. One could start from the smallest and easiest work at the beginning of the project or the end of the project.

The second strength of the current methods and tools to manage projects was the Excel template for timetables and duration. The template was ready with all the important fields, only the current date and the ending needed to be corrected. The Excel template was a quick way to see the project status. The template was also very editable if a project manager needs to add or remove some information, it was very quick. Also, very basic knowledge of Microsoft Excel was enough, and no extra training was needed to use it. The company did not need to invest extra to purchase the license of Microsoft as these were already purchased and available for all project managers.

The third strength of the current methods and tools to manage projects was the detailed process map available from the database. The process map had 11 different stages with detailed processes. Each stage had all the important processes included with the work order. This was very clear to follow. The managers of the department could find it easily from the database as well. This helped to make the plan for every project.

4.4 Weaknesses of Current Methods and Tools to Manage Projects

The informants had several views about the current methods and tools to manage projects. The freedom to choose the order of your activity was good only when the project manager is experienced enough. The condition of the case company was that several new projects were adding up and new project managers were hired. This means that the new project managers did not have any idea where to start the project from. The activities chosen were often wrong and it did not help the purchasing department to order parts from the suppliers. If the delivery date for certain parts were long, the order of the activities which includes making drawings was late by project managers and directly affected the project duration. This indicated the importance of activity order.

The Excel template for making timetables was also a weakness as they did not update automatically. All the manual work was needed if the changes came to the Excel template. Also, the activities did not have any link between them. If one

activity is late, the date should be automatically updated for the next activity as the resources are limited. However, it was not the case. The Excel was also kept personal and could not be found in the database. Project timetables were not available to others but only to the project managers. This created uncertainty among the project managers. If one project manager needs extra help to finish the project on time, the status of the other projects and experts involved in that project were unknown and this caused stress to the project managers.

The detailed process map was created from the department managers' point of view and was not usable to the project managers. It was in detail but made for department managers. The activities were not broken into smaller parts and the relationship between the activities was not created. The other weaknesses mentioned were no relationship between activities and time. The timing and status of the project were not visible to all project managers. The resource management for the project was also at a very surface level. The responsibilities of the project were divided but not clearly shown to all project managers.

4.5 Summary of Key Strengths and Weaknesses

The current state analysis of the case company revealed many areas to improve. The summary of the findings is listed in Figure 28 below.

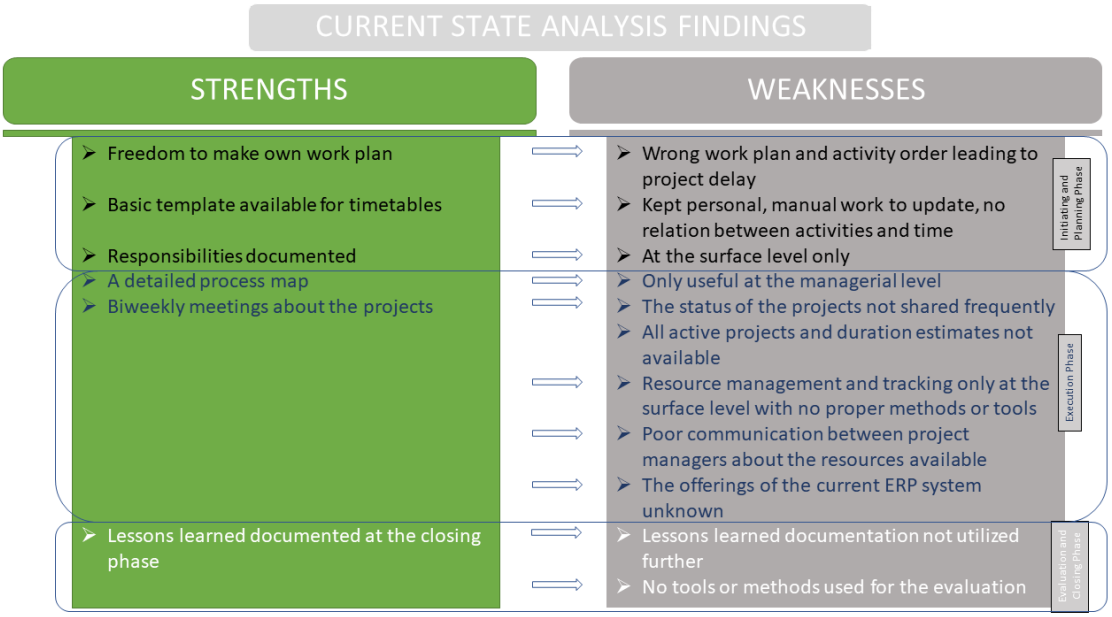

Figure 28. Strengths and Weaknesses

Figure 28 above shows the strengths and weaknesses of customer project management. These strengths and weaknesses are divided stage-wise into Initiating and Planning Phase, Execution Phase, and Evaluation and Closing Phase. The color coding of black, yellow, and white are used respectively for the stages to make it clear for the readers.

The most important project management tool for the case company was the ready templates. The template for making timetables was useful but was not widely used. Most informants stressed the issues with the timetable creation tool in Excel. The responsibilities of the project manager were documented properly but at the surface level only.

The next section (Section 5) of this research is creating an initial action plan proposal to manage customer projects. The strengths and weaknesses found in the CSA are utilized with the Conceptual Framework from section 3 in the next section. The idea of this process is to keep the strengths of the CSA but overcome the weaknesses by proposing an initial action plan.

5 Creating an Initial Action Plan Proposal to Manage Customer Projects

In this section, the methods and tools found from the conceptual framework were combined with the CSA findings to create the initial action plan proposal. This section includes an overview, a description of the Proposal Building processes for three different project steps, and a summary of the proposed initial actions.

5.1 Overview of the Initial Action Plan

The data collection for this stage was completed in two different workshops. Both workshops started with a presentation of the Conceptual framework available and the findings which showed the strengths and weaknesses of the current methods and tools to manage customer projects. The focus of the meetings was on building the initial solutions for the issues that emerged and on the objective of the Thesis. The conclusions from the meetings were finally documented and categorized into the standard 3 stages which the study follows.

The same stakeholders were chosen from the earlier data collection stage as the stakeholders had a good idea about the topic. This made perfect sense as it saved time for the reexplanation needed if new stakeholders were included. The stakeholders also felt that they were involved and had a chance to affect the outcome of the proposal building. The date and time were chosen to involve all those stakeholders from the earlier stage. The meeting also had the option to join online through Teams software, but everyone was able to attend physically and did not have to use other mediums.

The participants of the meeting were focused during the session. The meeting room was reserved for an entire hour for the Proposal Building. The stakeholders had the phone silenced and therefore, stayed focused during the entire session. The participants were actively listening during the presentation part and made some comments on the topic when they had something to add. Some questions were also asked when the topic was not clear to them. This added more value to the entire session as they were participating actively.

After the presentation part, open discussion was started immediately. The researcher opened an opportunity for the participants to get involved by asking the question of whether the solution for the issues found can be built from the literature presented. The researcher then asked for permission to record the session and continued listening actively. The session was also documented as much as possible.

The stakeholders provided their ideas and also listened and commented on other participants' insights. The session continued until the end of the entire hour reserved.

5.2 Building Proposal concerning the Initiating and Planning Phase

The strengths and weaknesses that emerged in the CSA stage were combined with the conceptual framework to build the proposal to tackle the issues found in the case company. This section states an action plan for Proposal Building for the initiating and planning phase which is presented in Table 11 below.

Table 11. Action Plan Proposal for Initiating and Planning Phase

STAGE	Action (what needs to be done)	Who	When (week)	Category	Priority	Target (0-100%)	KPI
INITIATING AND PLANNING PHASE	Define work plan and activities	Project Manager	23	Mandatory	High	100%	Network Diagram and the right order of Activities
	Take WBS into use	Project Manager	23	Mandatory	High	80%	Mini activities and milestones
	Define activities duration	Design Director	23	Should have	Medium	50%	Timeframe
	Use main variables from the available template to create a schedule	Project Manager	24	Should have	Medium	80%	Timetable
	Select project manager and members with the help of available documents	Design Director	24	Mandatory	High	100%	Project manager and members
	Take the Responsibility Matrix into use	Design Director	24	Could have	Low	50%	Responsibility division
	Create a RACI chart and make it accessible to all stakeholders	Design Director	25	Mandatory	High	100%	Roles and responsibilities

As shown in Table 11 above, an action plan was made for the first stage and was given to Project Manager, and was scheduled for week 23. The time was chosen

in the sense that a new project was starting on week 23, 2023 for the case company and also with the consideration that the research would be completed by then to fully utilize the action plan. This action was categorized as Mandatory and given high priority as it was a very important step while starting a project. The target here was considered 100% as this action was the base step for managing a project and the KPI was the ready Network Diagram and the right order of activities to be verified with a meeting with stakeholders.

This second action of taking WBS into use was also scheduled for week 23 also, kept in the Mandatory category with a high priority. The target here was reduced to 80% as taking WBS into use is a big task and even if it is only 80% ready for use, it would be still possible to initiate the work. However, this needs to be completed 100% soon.

The third action proposed was defining the duration of the activities. This action was assigned to the Project manager for week 23. The category however was reduced to Should Have with medium priority as the projects were finished earlier without a defined duration. The target here was only 50% as the project can be completed with only half of the activities duration defined.

The fourth action proposed was using the main variables from the available template to create a schedule. This action was given to the project manager for week 24 and was kept in the Should Have category with medium priority. It was given a target of 80% to cover the most important activities at this stage. The important part of this action was to create a timetable.

The fifth action was selecting a project manager and members with the help of available documents. This action was very important for any project to divide the responsibilities. Therefore, it was a mandatory action with a high priority with a need to complete 100%.

The next action proposed was taking Responsibility Matrix into use for week 24. This task was assigned to the DD as he was responsible for choosing the project manager and members for a particular project with activities. This action was kept

in a low category of Could Have with low priority and targeted for 50% completion. The KPI in the end was divided responsibility among the project stakeholders.

The action of creating a RACI chart and making it accessible to all stakeholders was given to the DD for week 25 with Mandatory category and high priority. The target was 100% to take the RACI chart into practice for all projects from start to finish. The KPI from this action was defined roles and responsibilities.

5.3 Building Proposal concerning the Execution Phase

The second proposal building was for the execution phase. The action here proposed addresses multiple issues that emerged during the CSA stage with the best theoretical practices to create an initial proposal for the Execution phase as shown in Table 12 below.

Table 12. Action Plan Proposal for Execution Phase

STAGE	Action (what needs to be done)	Who	When (Week)	Category	Priority	Target (0-100%)	KPI
EXECUTION PHASE	Educate Project Managers about CPM, ESS, LSS, and Slacks	Design Director	26	Should have	Medium	100%	Familiar with basic terms
	Use a detailed process map and WBS from the initiating stage to make a Gantt Chart and review it in biweekly meetings	Project Manager	27	Mandatory	High	100%	Gantt Chart sample
	Make the Gantt Chart accessible for all stakeholders for project status	Project Manager	27	Should have	Medium	100%	Accessible to everyone

STAGE	Action (what needs to be done)	Who	When (Week)	Category	Priority	Target (0-100%)	KPI
	Take Resource Leveling and Smoothing into use	Design Director	30	Could have	Low	50%	A ready template
	Utilize Resource Leveling and Smoothing tools and methods	Design Director	40	Could have	Low	25%	Use of template
	Make the Resource management and tracking accessible for everyone to increase communication between project managers	Design Director	45	Could have	Low	50%	Template available to all project managers

As shown in Table 12, the actions proposed were divided between the DD and the project manager. Only the action of creating a Gantt Chart was considered mandatory with high priority and a target of 100%. Regarding actions for resource management, all of these were put in the Could Have category with low priority with plenty of time to allow the DD to focus on the main project.

5.4 Building Proposal concerning the Evaluation and Closing Phase

Table 13 below depicts the initial action proposal prepared for the third and final phase of Evaluation and Closing.

Table 13. Action Plan Proposal for Evaluation and Closing Phase

STAGE	Action (what needs to be done)	Who	When (week)	Category	Priority	Target (0-100%)	KPI
EVALUATION AND CLOSING PHASE	Analyze lessons learned documentation to evaluate the project	Design Director	50	Could have	Low	50%	Checklist for things to implement and avoid
	Use the Project Crashing method to trade cost and time	Design Director	50	Should have	Medium	50%	Project Crashing template

As shown above, in Table 13, the actions of analyzing lessons learned and using the project crashing were assigned to the DD, scheduled for week 50, and not kept in the highest category and priority.

5.5 Summary of the Initial Action Plan Proposal

This section summarizes the actions proposed for three different stages. It also describes the reasons behind proposing the actions for the particular stage.

For the initiating and planning phase, the first action proposed was to define a work plan and activities. The work plan gives an overall idea of the activities and their weights; the surface idea of the main activities and their completion to finish the project. This is an important step before furthermore dividing the activities.

The idea of keeping the freedom to make own work plan in the case company fits well with WBS from the conceptual framework as it focuses on dividing the activities into smaller activities but not the sequence of the task. Thus, the

implementation of the WBS gives the mini activities in the project for the second action proposed.

The third action proposed gives the duration of the activities with the help of data from earlier projects. The timetable template in Microsoft Excel is useful at this stage to collect the important variables and is combined with durations to make a schedule. Scheduling, the fourth action proposed, uses WBS and develops timetables furthermore to track the timetables in the project management process.

The fifth action proposed helps to choose the project manager and members for a project with the help of available documents from previous projects.

To address the issue of responsibilities documented at the surface level only, a Responsibility matrix is recommended as a sixth action. This matrix helps to divide responsibilities among experts. Each activity is assigned to the responsible person according to their expertise and documented as a responsibility matrix. This document should be also accessible to the stakeholders.

The RACI chart was the development of the responsibility matrix, and this provided full support for the Project Manager as the roles and responsibilities were clearly stated in the chart for the project members as well. This RACI chart solved the issue of having responsibility divided on the surface level only.

The activities have at least one responsible person. Others are also involved in the form of Accountable, Consult, and Inform. This chart clearly states the responsibility for the activity and gives a good overview of who should be contacted if a problem arises. The RACI chart is also a very good tool to do the workload analysis quickly among the project members.

The strengths and weaknesses which the above-described actions handle for the Initiating and Planning Phase are listed below:

- Freedom to make own work plan
- Basic template available for timetables
- Responsibilities documented
- Wrong work plan and activity order leading to project delay
- Kept personal, manual work to update, no relation between activities and time
- At the surface level only

For the execution phase, the strength of the detailed process map was overshadowed by the process map not being very useful for the stakeholders. However, the process map is useful while making a Gantt Chart. The Gantt Chart creates a timetable for a project with relationships between the activities. This is very useful to see the progress of a project. Therefore, the action is proposed to create a Gantt Chart.

To make a Gantt Chart and make it available to the stakeholders, education is needed about the CPM method, ESS, LSS, and slacks. The conceptual framework provides the needed education and ideas to create a Gantt Chart. This also gives the duration estimates for all the active projects. The sharing of the Gantt Chart created should be done from the database and should be accessible to the stakeholders.

The actions of taking Resource Leveling and Smoothing into use are proposed to solve the issue of not having any methods or tools for resource management. The output of this action is a detailed template. The template solves the issue of having the documentation at the surface level only.

The resource leveling and smoothing template is then further utilized in the project and is shared in the database so that all the project managers can access it easily.

The strengths and weaknesses which the above-described actions handle for the Execution Phase are listed below:

- A detailed process map
- Weekly meetings about the projects
- Only useful at the managerial level
- The status of the projects not shared frequently
- All active projects and duration estimates were not available
- Resource management and tracking only at the surface level with no proper methods or tools
- Poor communication between project managers about the resources available
- The offerings of the current ERP system were unknown

For the evaluation and closing phase, the case company had lessons learned well documented during the closing phase of the project. However, it was not utilized further and needed analysis to evaluate the project. The checklist for things to implement and avoid was taken as a KPI above which was recommended to help the analysis and evaluation process. Furthermore, the Project Crashing technique was proposed during this phase to resolve the issues of not having any methods or tools in shortening the project with the costs involved.

The strengths and weaknesses which the above-described actions handle for the Evaluation and Closing Phase are listed below:

- Lessons learned documented at the closing phase
- Lessons learned documentation not utilized further
- No tools or methods were used for the evaluation

This concludes the initial action proposal and the next section of the research is the validation of the proposed action plan to manage customer projects.

6 Validation of the Proposed Action Plan to Manage Customer Projects

The actions were proposed to solve the issues that emerged in the case company while managing customer projects in the previous section. This section discusses the validation process starting with an overview and the final stepwise output which this study follows.

6.1 Overview of the Validation of the Proposed Action Plan

The data collection for this stage was completed in a meeting with the Design Director of the Engineering and Design department. The meeting started with a brief introduction about what happened in the previous section of the initial action proposal building. The results documented and printed in the paper were given to the director and were kept by the researcher itself. The idea of giving a hard copy to both parties was that the changes could be marked if needed. The papers were collected back at the end of the meeting. The screen of the researcher was also mirrored to a bigger screen that showed the same initial action proposal. The session was also recorded with the permission of the informant. The time reserved for the meeting was 1 hour and it lasted nearly until the end.

The informant was very focused on the topic. Ideas were shared frequently and questions were asked if something was not clear. As the meeting was conducted in a separate room, there was no disturbance from the outside.

The researcher briefly introduced the table to the informant and explained what the headers mean and the intention behind them. The action proposed was divided stage-wise which this study follows and the meeting started from the Initiating and Planning Phase and continued to the Execution Phase and finally to the Evaluation and Closing Phase.

6.2 Validation concerning the Initiating and Planning Phase

The validation of the proposed actions concerning the Initiating and Planning Phase is depicted in Table 14 below and the changes are highlighted either in a light blue color or with a red oval for clarity.

Table 14. Validation of proposed actions concerning the Initiating and Planning Phase

STAGE	Action (what needs to be done)	Who	When (week)	Category	Priority	Target (0-100%)	KPI
INITIATING AND PLANNING PHASE	Select project manager and members with the help of available documents	Design Director	23	Mandatory	High	100%	Project manager and members
	Define work plan and activities	Design Director	23	Mandatory	High	100%	Network Diagram and the right order of Activities
	Take WBS into use	Project Manager	23	Mandatory	High	80%	Mini activities and milestones
	Define activities duration	Project Manager	23	Should have	Medium	50%	Timeframe
	Use main variables from the available template to create a schedule	Project Manager	24	Should have	Medium	80%	Timetable
	Take the Responsibility Matrix into use	Design Director	24	Could have	Low	50%	Responsibility division

STAGE	Action (what needs to be done)	Who	When (week)	Category	Priority	Target (0-100%)	KPI
	Create a RACI chart and make it accessible to all stakeholders	Design Director	25	Should have	Medium	100%	Roles and responsibilities
	Take the Baseline and Target S-Curve into use	Design Director	25	Should have	Medium	100%	S-Curve template

As shown in Table 14 above, the proposed action for Selecting a project manager and members with the help of the available documents were moved from the 5th action to the first. The informant raised the question of getting any project-related work done without selecting the responsible for the activities. This was a very valid question and the action order was not noticed at the time of the initial proposal building. Therefore, the action proposed was moved to the top of the list with the timeframe of week 23 as this should be the first action to be completed.

The second adjustment concerned the proposed action of defining activities duration. The responsible person was changed from the DD to the project manager. The reason behind it was the tight schedule of the DD at the start of the project. Supervisors usually have many responsibilities and meetings to attend and do not have much time to invest in extra activities.

The third change had to do with creating the RACI chart and making it accessible to all stakeholders. As the team was still small with only 10 experts working in the Design and Engineering department at the case company, the need for creating the RACI chart was not considered mandatory and the category was changed to Should Have only. The priority was also reduced from high to medium.

The final change made to the proposed action list was the addition of S-Curve tools. The baseline and target S-Curve were added to the planning stage. The activity was assigned to the DD for week 25. The data from the ERP system is taken into use to make the S-Curves and was put into the Should Have category with medium priority. The target was given 100% so that a complete template is available in the planning phase and will be used further in the coming stages to compare the progress of the project.

6.3 Validation concerning the Execution Phase

The validation of the proposed actions concerning the Execution Phase is depicted in Table 15 below and the changes are highlighted in a light blue color for easy reference.

Table 15. Validation of the proposed actions concerning the Execution Phase

STAGE	Action (what needs to be done)	Who	When (Week)	Category	Priority	Target (0-100%)	KPI
EXECUTION PHASE	Educate Project Managers about CPM, ESS, LSS, and Slacks	Researcher	26	Should have	Medium	100%	Familiar with basic terms
	Use a detailed process map and WBS from the initiating stage to make a Gantt Chart and review it in biweekly meetings	Project Manager	27	Mandatory	High	100%	Gantt Chart sample
	Make the Gantt Chart accessible for all stakeholders for project status	Project Manager	27	Should have	Medium	100%	Accessible to everyone

STAGE	Action (what needs to be done)	Who	When (Week)	Category	Priority	Target (0-100%)	KPI
	Take Resource Leveling and Smoothing into use	Design Director	30	Could have	Low	50%	A ready template
	Utilize Resource Leveling and Smoothing tools and methods	Design Director	40	Could have	Low	25%	Use of template
	Make the Resource management and tracking accessible for everyone to increase communication between project managers	Design Director	45	Could have	Low	50%	Template available to all project managers

As shown in Table 15 above, the only change came from the proposed action of educating project managers about CPM, ESS, LSS, and Slacks. The action was assigned from the DD to the researcher. The DD was not fully familiar with the project management terms used in this research at the time of the meeting and was not sure about the schedule also. Therefore, the action proposed was assigned to the researcher. The researcher at that time had the best knowledge in the whole Design and Engineering department and it was felt that he is the best person to complete the activity.

The other proposed actions were not changed as the activities were carefully planned already according to the informant and looked feasible.

6.4 Validation concerning the Evaluation and Closing Phase

The validation of the proposed actions concerning the Evaluation and Closing Phase is depicted in Table 16 below and the changes are highlighted in a light blue color.

Table 16. Validation of the proposed actions concerning the Evaluation and Closing Phase

STAGE	Action (what needs to be done)	Who	When (week)	Category	Priority	Target (0-100%)	KPI
EVALUATION AND CLOSING PHASE	Analyze lessons learned documentation to evaluate the project	Design Director	50	Could have	Low	50%	Checklist for things to implement and avoid
	Use the Project Crashing method to trade cost and time	Design Director	50	Should have	Medium	50%	Project Crashing template
	Use Costs Versus Time and Man-Hours Vs Time S-Curve for project analysis and evaluation	Design Director	52	Should have	Medium	50%	A ready template for the tools

As shown in Table 16 above, the proposed actions for the Evaluation and Closing Phase were accepted without any changes. However, the S-Curve tools were missing and was suggested to make an addition. The action proposal of using Costs Versus Time and Man-Hours for project analysis and evaluation was added and assigned to the DD for week 52. The timeframe here is a risk because of the holiday season as well. The activity was kept in the Should Have

category with medium priority. The target was given 50% and the KPI recommended was a ready template for the tools.

6.5 Summary of the Validations of the Proposed Action Plan

The validations were done stage-wise as mentioned in the earlier sections. The changes came only from a few proposed actions.

Out of a total of 7 proposed actions in the Initiating and Planning Phase, changes were made only for the three actions. The proposed action of selecting a project manager and members with the help of available documents was shifted to the top and made the first proposed action. The responsible person was changed for defining activities duration to the project manager. The category and priority for creating a RACI chart and making it accessible to all stakeholders was changed from mandatory and high to Should Have and medium.

The need for S-Curve tools was sensed at the validation stage for the Initiating and Planning Phase and was added as a last proposed action. This made a total of 8 proposed actions for this stage.

For the Execution Phase, out of the 7 actions proposed, only one item was revised. The responsible person for educating project managers about CPM, ESS, LSS, and Slacks was changed from the DD to the researcher. This concluded the validations for the execution phase.

For the final validation stage of the evaluation and closing phase, a total of 2 actions were proposed. Changes were not made to these as they were well-considered. However, the S-Curve tools were again added to the bottom of the list to make a total of 3 proposed actions.

This summarizes the validation of the proposed actions. The next section presents the conclusion of this thesis.

7 Conclusion

This section concludes the Thesis by starting with an executive summary, then the practical next-step recommendations followed by a self-evaluation of the Thesis Project Credibility and the closing words at the very end.

7.1 Executive Summary

The objective of the research was to propose an action plan to manage customer projects. The outcome of the research is the proposed action plan. This research helps the case company deal with the existing issues; for example not having proper methods and tools to manage customer projects, creating timetables, and booking resources. The design and engineering department is also growing bigger as the size of the case company is growing bigger. This means that the methods and tools to manage customer projects currently used need to be updated with time. More efficient methods and tools are needed.

The research followed the path of Design Research which concentrates on finding a real-time problem for a company and offering a solution to it. The data was collected with a qualitative method such as interviews, meetings and workshops. The research included 4 different stages starting from Conceptual Framework, which concentrated on finding best practices to manage customer projects, then the Current State Analysis which investigated the situation of the case company while managing customer projects. The third was the solution-building stage which was conducted with the stakeholders and the initial actions proposal was co-created. The last stage was the validation of the proposed actions and was conducted in a meeting to make the final list of proposed actions.

The conceptual framework was organized into three project phases; the Initiating and Planning phase, the Execution Phase, and the Evaluation and Closing Phase. The research follows this approach until the end. The initiating phase included a WBS, which breaks tasks further until it is no longer possible to break. The output of the WBS in terms of tasks and subtasks was used while dividing

the responsibility to create a responsibility matrix. The roles and responsibilities of the project members were divided and documented more by using a RACI chart which is the backbone of any project management as it distributes duties effectively. The planning phase is supported further with Baseline S-Curve and Target S-Curve. Finally, the schedule is made with tasks and subtasks to plan the project.

The execution phase introduced Critical Path Method(CPM), Early Start Schedule(ESS), Late Start Schedule(LSS), and slacks. The idea behind introducing all these terms in project management is to create a Gantt Chart which created an Activity Vs Time chart to create relationships between project activities which shows the progress of the project. Resource leveling and smoothing is used in project management for managing limited resources.

The last phase of project management, the Evaluation and Closing Phase, is concentrated on the project crashing for a cost-time trade-off. Costs Versus Time S-Curve and Man-Hours Versus Time S-Curve helped further for evaluation of the project.

The Current State Analysis started with a meeting with stakeholders one by one. It continued until the strengths and weaknesses of the current project management methods and tools were fully discovered. The findings were carefully divided into the three stages which the research follows.

The initiating and planning phase concluded that the timetable creation template needed an upgrade. A clear relationship between activities and time and more automatic updates in the timetable template was needed. The informants also underlined the need for clear roles and responsibility documentation so that the project managers and members can make sure that the main activities and processes do not go unnoticed.

In the execution phase, the CSA highlighted poor communication between project stakeholders despite having biweekly meetings. There were no duration

estimates for activities in an active project. The process of booking resources and tracking was not clear and needed proper methods and tools.

For the Evaluation and Closing Phase, no methods and tools were familiar and available to the project managers for use. These were the highlights of the CSA in the case company.

The third section of the research was creating an initial action plan proposal to manage customer projects. The outcome was co-created with the stakeholders. The proposed action plan was divided into three phases which the study follows.

A total of 7 actions were proposed for the Initiating and Planning phase which addressed the issues of activities division, timetables creation, and responsibility division. The timeframe was started from week 23 assuming that the new project will get started in the case company in the year 2023.

For the Execution Phase, a total of 6 actions were proposed to support the activities and time management with a Gantt Chart. The rest of the actions were proposed for resource management.

For the Evaluation and Closing Phase, analyzing old documents and project crashing were proposed to further support the project management and evaluation process.

The fourth section of the research was the validation of the proposed actions to manage customer projects. A meeting was conducted with the Design Director to validate the initially proposed actions which also followed the phase-wise approach.

For the initiating and planning phase, the validation changed the order of a proposed action. The proposed actions could be divided only after selecting a project manager and members and were changed from the fifth action to the first. Including the action of Selecting a Project Manager and Members, two other actions, defining the work plan and activities, and taking WBS into use were put

in the Mandatory category and were given high priority as the proposed actions. The S-Curve tools were also added to the proposed action list.

For the Execution Phase, the validation process changed the responsible person to the Researcher for the proposed action of educating project managers about CPM, ESS, LSS, and Slacks. Otherwise, no other changes were made to the initial proposed actions. Only one action was put in the Mandatory category with high priority and it was for the action of using a detailed process map and WBS from the initiating stage to make a Gantt Chart and reviewing it in the biweekly meetings.

For the validation concerning the Evaluation and Closing Phase, only the Costs Vs Time and Man-Hours Vs Time S-Curves for project analysis and evaluation were added to the existing list of proposed actions.

7.2 Practical Next Step Recommendations

This subsection is the recommendations for the practical next steps, which the case company could follow.

The outcome of the research is the proposed action plan to manage customer projects. The case company needs to prepare beforehand to implement the proposed actions. Meetings need to be conducted to discuss the outcome of the thesis and the implementation of the proposed actions.

The action plan was proposed with an action table, and it gives full details of the actions. The timeframe for each action is also given in the action table. The supervisor can already book the timeslots to implement the proposed actions. The responsible person for the implementation of the proposed actions should be made aware early enough before the implementation starts. It gives the flexibility to perform the background work if needed.

The implementation process of the proposed actions might need the purchase of the licenses for the software. For example, if the Design and Engineering

department wants to use the Gantt Chart for the activities tracking in real-time, the purchase of licenses is needed. This should be done early enough so that the proposed actions are feasible. If the use of Microsoft Excel is preferred to make Gantt Charts, one should be sent to training as creating a Gantt Chart in Excel needs intermediate skills.

The implemented actions as methods and tools from this research need to be integrated into the project steps. The actions should be made as an automated process. If a new project starts, the actions should be starting automatically if possible. Therefore, the project managers could not skip the process by mistake or even if they wanted to.

The implementation of methods and tools to manage customer projects is not a one-time process, but rather a continuous development of the methods and tools. The investigation and improvement should be done over time. Time and budget should be allocated to strengthen the project management methods and tools because these are the bases of any successful project.

7.3 Self-evaluation of Thesis Project Credibility

The case company offered multiple choices of topics for research. Upon careful consideration and the degree topic (Industrial Management), the technical topics were filtered out. The topic of doing an investigation for timetables, and resource management remained. Thus, proposing an action plan to manage customer projects was selected as the research topic. The outcome of the research is the proposed action plan to manage customer projects. Detailed actions are proposed to upgrade the methods and tools in the case company managing customer projects.

The researcher belongs to the Design and Engineering department. As the researcher at that time was fairly new to the company, most of the issues and improvement needing topics were not familiar. The informal talks during the coffee break or lunch provided some basic knowledge before the real data

collection on the topic. The data collection was done through interviews with stakeholders. The interviews targeted the project managers from the Design and Engineering department.

7.3.1 Validity and Credibility

According to Bryman & Bell (2005, p. 50), the term "Validity" is typically only used in connection with quantitative research. However, both internal and external can be used to determine validity.

The internal validity of a study is established by its methodology, which includes the research design, operational definitions, variable assessment methods, and the inclusion or exclusion of certain measures. The level of confidence that can be placed in the study's findings is influenced by its internal validity. (Bryman & Bell, 2005, p. 50).

External validity refers to a study's capacity to be generalized to a broader population beyond its original sample. This is determined by the measures taken to ensure generalizability, such as the sampling method and the variables measured. (Bryman & Bell, 2005).

As Applied Research focuses on solving an ongoing issue for a particular organization, external validity to generalize is not applicable. Therefore, this study follows Internal validity.

The credibility and internal validity of this study were established through triangulation. In the current state analysis stage, multiple methods and diverse sources were employed, for example, the documents were analyzed which were available from the database related to the project management, informal coffee and lunch hour talks were conducted, and finally, interviews were held. During the co-creation of the initial building of the proposed action plan, workshops were held with multiple experts to ensure credibility.

The outcome of this study is the proposed action plan to manage customer projects which are divided into phases. Each phase has multiple actions proposed and is only applicable to the case company. However, if the situation of another company is the same and needs some ideas to review the current methods and tools to manage customer projects, the proposed actions above are useful.

7.3.2 Reliability

The data collection details presented in Section 2.3 for this research give the overall information. The one-to-one meetings were conducted in different meeting rooms in the case company during working hours. However, one meeting was completed online with the Teams software which lasted about 45 mins. The permission from the informants resulted in recording the interviews. The field notes are also reserved and were used for analysis purposes. Full details of the CSA interview template can be found in the appendix.

The workshop for the building of the initial actions proposal was also recorded and used for analysis. The session lasted almost an hour in the main meeting hall of the case company with the availability of the big screen.

The notes and the recording are also available for the validation stage. The meeting with Design Director lasted an hour and was completed in the small meeting room of the case company.

7.3.3 Logic

The logic for choosing the thesis topic is to solve issues or offer recommendations to the issues in the case company. The research method chosen is Design Research as this research approach focuses on solving the real problem in an organization. The data collection approach was chosen as qualitative over quantitative as it follows direct interviews and workshops. These non-numerical

data were collected and recorded as audio and further analyzed to conclude the research.

7.3.4 Relevance

The topics for the research were initially extracted by the experts in the case company who have many years of prior experience in managing customer projects. The genuine need for improvements in current methods and tools to manage customer projects was felt and thus, the research topic picked is very relevant to the case company's needs and issues.

The data collection for the Current State Analysis stage was done through interviews with the stakeholders. The project managers and the design director were involved in the process to find the strengths and weaknesses of the current way to manage customer projects. As the informants had experiences with the project management topic, the quality output was received. This shows the relevancy of the data collection for the CSA stage.

The initial building of proposed actions was done with the same informants who had detailed knowledge of project management and were interviewed in the CSA stage. Therefore, the informants were fully aware of the research topic and the state. The workshop conducted went smoothly as there was no time wasted on revising the earlier stage in detail as the quick review was enough for the informants. Again, the informants were project managers, thus, the output of the research was relevant to the research topic.

The validation of initially proposed actions was done by the design director. The design director is involved every day in project management. Therefore, it was very relevant to choose the design direction for this stage.

The output of the research is Proposed actions to manage customer projects. The output offers phase-wise actions to upgrade methods and tools to manage customer projects. This applies to the case company as this research proposes

actions to solve the issues found initially. The proposed actions are easy to implement as well without big plans or spending.

7.4 Closing words

The accomplishment of the thesis objective was highly gratifying as it generated a practical solution for the case company that could be implemented to enhance customer project management methodologies and tools. Although the researcher was unfamiliar with the topic, the process of actively engaging with it was a valuable learning experience that will be advantageous. Furthermore, the research findings provide significant benefits to the case company, as the proposed actions directly address the current limitations in the available project management tools and methods.

The process of enhancing project management methods and tools is an ongoing effort. Even a small investment can yield significant benefits for the case company by enabling them to run their projects effectively and efficiently. By utilizing tools such as Gantt Chart and RACI Chart, communication can be improved drastically. These seemingly small methods and tools can have a significant impact on managing customer projects, ensuring timely completion, and increasing profitability, ultimately contributing to the company's future success.

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Appendix 1: CSA questions

1. What are the pros and cons of the current project management process? What does work well and what does not?

2. What tools are used for time and other resource estimation? What works and what does not?

3. How are activity and time managed at the moment?

4. How are Resource Leveling and Smoothing done now?

5. How is the responsibility divided into the different stages of project management? Is the Responsibility Matrix in use? What are the important variables?

6. Would you like to add anything more about project management?

Appendix 2: CSA Findings

STRENGTHS	WEAKNESSES
❖ The freedom to create an order of the activities	❖ Wrong activity order leading to project delay
❖ Highly customizable ready template for timetables in Microsoft Excel ❖ No extra costs or training was needed to use Excel	❖ Kept personal, manual work to update, no relation between activities and time
❖ The detailed process map	❖ More useful for managerial level
❖ Biweekly meetings about the projects	❖ The status of the projects not shared more frequently ❖ All active projects and duration estimates were not available
❖ Responsibilities documented	❖ In surface level ❖ Responsibility matrix not in use
	❖ Resource management and tracking only at the surface level ❖ No proper methods or tools were available
	❖ Poor communication between project managers about the resources available
	❖ The offerings of the current ERP system were unknown
	❖ No WBS in practice