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Planning and Follow-Up Processes in Production and Its Influence on Productivity

A Case Study of Two Projects in the Swedish Construction Sector

Master's thesis in Design and Construction Project Management

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Summary

The construction industry is behind other sectors in terms of efficiency improvements and has low productivity levels. Swedish construction projects are often delayed, which is usually related to low productivity and inefficient working methods. The current methodologies used for the planning and follow-up processes in production have been shown to be difficult to apply in practice, with limited support to examine productivity. Since there are multiple different definitions of productivity, the overall development of productivity has slowed down and created difficulties in measuring and using the term in the construction sector. This study has therefore narrowed its focus down to efficiency and effectiveness when referring to productivity. The aim of this study was to examine how planning and follow-up processes were conducted, whether there are standardised approaches or if each project has its own approach. It further investigated what challenges existed related to those processes and in turn how they affected productivity and what improvements could be done to enhance it. To achieve the aim of this study, an interview study and a case study were done where two ongoing building projects in one company in the Swedish construction industry were examined. The conclusions that can be drawn based on this study were that the planning and follow-up were conducted with varying approaches of the Last Planner System (LPS). The chosen approach in the projects varied depending on the individuals involved and relied on their knowledge, priority and focus on these processes. Another factor that influenced how planning and follow-up were carried out was the lack of clear structure and requirements on a project level. A significant challenge which impacted the outcome was collaboration between those involved in the planning process. The study showed several ways that the planning and follow-up processes could be improved to potentially enhance productivity in production. It highlighted the need of securing a general knowledge level and implementing clear requirements and guidelines for how to work with planning and follow-up on a project level to be able to enhance productivity. The study further made it visible that the culture and priority on planning and follow-up varied between the projects and was highly dependent on individuals but also affected by how the company relates to them. Establishing a culture that promotes the importance of planning is essential to accomplish a project environment that enables proper planning and follow-up processes, allowing projects to focus on improving productivity.

Keywords: planning, follow-up, last planner system, productivity, production, case study.

Planerings- och uppföljningsprocessen i produktion och dess inverkan på produktiviteten - En fallstudie av två projekt inom den svenska byggsektorn

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Sammanfattning

Byggbranschen ligger efter andra sektorer vad gäller effektivitetsförbättringar och har låg produktivitet. Det är vanligt att svenska byggprojekt upplever förseningar, vilket ofta är kopplat till låg produktivitet och ineffektiva arbetsmetoder. De nuvarande metoderna som används för planerings- och uppföljningsprocesserna i produktionen har visat sig vara svåra att tillämpa i praktiken med begränsat stöd för att undersöka produktivitet. Eftersom det finns flera olika definitioner av produktivitet har den övergripande utvecklingen av produktivitet saktat ner och skapat svårigheter att mäta och använda termen inom byggsektorn. Denna studie har därför begränsat fokuset ner till effektivitet när man hänvisar till produktivitet. Syftet med denna studie var att undersöka hur planerings- och uppföljningsprocesser genomfördes, om det finns standardiserade metoder eller om varje projekt har sin egen metod. Den undersökte vidare vilka utmaningar som fanns relaterade till dessa processer och i sin tur hur de påverkade produktiviteten och vilka förbättringar som kunde göras för att förbättra den. För att uppnå syftet med denna studie genomfördes en intervjustudie och en fallstudie där två pågående byggprojekt i ett företag inom den svenska byggbranschen undersöktes. Slutsatserna som kan dras baserat på denna studie var att planering och uppföljning genomfördes med varierande metoder av Last Planner System (LPS). Det valda tillvägagångssättet i projekten varierade beroende på de inblandade individerna och förlitade sig på deras kunskap, prioritering och fokus på dessa processer. En annan faktor som påverkade hur planering och uppföljning genomfördes var bristen på tydlig struktur och krav på projektnivå. En betydande utmaning som påverkade resultatet var samarbetet mellan de inblandade i planeringsprocessen. Studien visade flera sätt som planerings- och uppföljningsprocesserna kunde förbättras för att potentiellt öka produktiviteten i produktionen. Den belyste behovet av att säkerställa en generell kunskapsnivå och implementera tydliga krav och riktlinjer för hur man arbetar med planering och uppföljning på projektnivå för att kunna öka produktiviteten. Vidare synliggjorde studien att kulturen och prioriteringen av planering och uppföljning varierade mellan projekten och var starkt beroende av individer men också påverkad av hur företaget förhåller sig till dem. Att etablera en kultur som främjar vikten av planering är avgörande för att åstadkomma en projektmiljö som möjliggör korrekta planerings- och uppföljningsprocesser, vilket gör att projekt kan fokusera på att förbättra produktiviteten.

Nyckelord: planering, uppföljning, last planner system, produktivitet, produktion, fallstudie.

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Julia Glans, Adam Goncalves, Gothenburg, July 2025

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1

Introduction

The introduction chapter presents the context in which the research has been conducted. It introduces the topic of planning, follow-up and productivity in production, providing background information to frame the study. Furthermore, it outlines the aim and objectives of the research, followed by the research questions and clarifications of them. The chapter also defines the scope of the study by clarifying its delimitations.

1.1 Background

In comparison to other industries, projects in the construction industry are unique and characterised by their own peculiarities (Koskela, 2000). Firstly, each construction project is typically considered unique, a one-of-a-kind, that is not repeated in exactly the same way. The construction projects are also usually carried out on-site, meaning they are influenced by weather conditions and the specific characteristics of the location. Finally, projects are executed by temporarily assembled teams, which means that both the organisation and collaboration can differ from one project to another. The construction industry also differs from other industries due to high levels of uncertainty and risks that can hinder productivity (Daniel et al., 2014).

Multiple studies and reports point out the low productivity levels in the construction industry and highlight that it trails behind other sectors in terms of efficiency improvements (Fulford & Standing, 2014). According to Boverket (2022) it is common for Swedish construction projects to experience delays, which are often linked to low productivity and inefficient working methods. According to Dallasega et al. (2020) around 70 percent of all projects within the construction sector end up in time overruns due to low productivity and inefficiencies. There are multiple definitions of productivity, and with the term being frequently used with different interpretations, it is often misunderstood, making it counterproductive (Tangen, 2005). Studies have shown that the overall development of productivity can slow down as a result of many definitions and interpretations and there are difficulties in measuring and using the term productivity in the construction sector (Yi & Chan, 2014).

Since productivity is a widely used term with many definitions, this study will focus on Sink and Tuttles's (1989) definition of productivity, defined in two parts, efficiency and effectiveness, which refers to "doing things right" and "doing the right things". The first part, efficiency means performing tasks properly and achieving the desired results while using the least number of resources (Bernolak, 1997; de Been, van der Voordt, & Haynes, 2016). The second part, effectiveness, ensures that the right activities are carried out, meaning all efforts contribute to the established goals.

Besides the term productivity being defined in various ways, the construction industry also has wide deficiencies in the systematic follow-up of productivity in production on the project level (Hamzeh, Ballard, & Tommelein, 2008; Jonsson, 2020). When disregarding the unique characteristics of the construction industry, low productivity and poor results can largely be explained due to improper planning and ineffective monitoring and control mechanisms in the production phase (Irfan et al., 2021). The current planning and follow-up methodologies have been shown to be difficult to apply in practice and there is limited support for the assessment of the real-time construction progress and project status which is necessary to be able to examine productivity in the production (Dallasega, Marengo, & Revolti, 2021).

1.2 Aim

The primary aim of the study is to examine how planning and follow-up processes are carried out in two different production projects within the same company and to identify key challenges related to planning and follow-up. By identifying those, the study will strive to contribute insights into why these challenges exist and possible areas for improvement. The study also aims to identify how the chosen approach of planning and follow-up affects productivity, exploring what factors impact and how to work with these to potentially enhance productivity in production.

1.3 Research Questions and Clarification

To achieve the aim of the thesis, a case study will be conducted that looks at two projects in a company that operates in the Swedish construction and civil engineering industry. The thesis is narrowed down to two research questions formulated as follows:

RQ1 *How are planning and follow-up conducted in production in building projects and what are the main challenges*

RQ2 *How can the planning and follow-up processes be improved to potentially enhance productivity in production?*

The first question concerns the processes and methods used in production for planning and follow-up. It investigates how the different cases proceed in the planning process in production and what impact the approach has on the project. It will also cover the exploration of finding out if there currently exists a standardised way of working

with those processes or if each project has a different approach. Lastly, it will also explore how data for follow-up is collected and further analysed in a project and if it is used to continuously improve the planning process.

The second question addresses how the planning and follow-up processes affect and how they can be used to enhance productivity in production. It explores what methods and tools are currently being used in these projects. It also concerns how the follow-up process can be developed to focus on productivity improvement and further enhance it.

1.4 Delimitations

The study will be limited to planning and follow-up activities on-site and productivity connected to those aspects of production in the construction of buildings only. Other aspects that are not directly linked to production will be mentioned if they influence the on-site planning and follow-up activities. As there are a variety of definitions of productivity this thesis will not look into things outside of efficiency and effectiveness. The scope is narrowed down to production follow-up from the contractor's perspective, focusing specifically on daily production planning and extending up to six-month planning. The study will focus exclusively on active projects within one Swedish company, and the number of projects will be limited to two.

2

Literature Overview

This chapter provides the theoretical background which the results, analysis, and conclusions of the study are built upon. It is structured into four main sections, each presenting relevant literature and current research. The first section focuses on planning in production and the second explores approaches to follow-up. The third section focuses on productivity and how it's affected by the planning and follow-up processes. The last section covers soft aspects that impact the previous topics.

2.1 Planning in the Production Phase of Construction Projects

Planning is a structured decision-making process aimed at anticipating and organising future activities to achieve desired outcomes efficiently (Ackoff, 1970; Laufer, Tucker, Shapira, & Shenhar, 1994; Mintzberg, 1981). Planning decisions are characterised by three key attributes, with the first one being that the decisions must be forward-looking, meaning that they must be made in advance and not postponed until the moment of action (Ackoff, 1970). The second one is that decisions are interdependent, meaning that the outcome of one decision depends on at least one other decision. The third attribute is that the decisions are goal-oriented and aim to achieve desired future states that would not have occurred without the plan. Furthermore, planning is often described as controlling the future, meaning that for a process to qualify as planning, the actions must align with the decisions made (Mintzberg, 1981; Wildavsky, 1973).

A plan represents the formalised outcome of the planning process (Laufer et al., 1994). Schedules, among the various plans, are the most used in construction projects. They outline the contractor's plan for project completion with a focus on the timing of activity sequences in which they will be executed. A production program is created and established for every construction project (Hansson et al., 2021). During production, more detailed plans are developed continuously, like monthly and weekly plans which are based on the production program.

2.1.1 The Planning Process from Daily Planning up to Six Months Planning Ahead

Planning is one of the most important activities when structuring the construction process and occurs at several different levels in production, starting with a production program and ranging down to daily plans (Josephson & Saukkoriipi, 2009). Production planning that ranges from daily planning up to six months ahead should include planning for and by the client, designers, the contractor's headquarters, site management, subcontractors and suppliers (Laufer et al., 1994). The planning process that covers daily planning up to six months ahead, should according to Laufer & Tucker answer the following questions:

1. *What* activities should be carried out?
2. *How* should the activities be performed?
3. *Who* is responsible for each activity and what resources are required?
4. *When* should activities be performed? (in terms of sequence and scheduling)

Everyday surprises occur in production and therefore tasks continuously need to be modified, added, or removed, which means that schedules, budgets, production estimates, and work methods must be updated to maintain control and ensure that the documentation is up to date (Hansson et al., 2021; Josephson & Saukkoriipi, 2009). When the activity cannot be carried out as planned due to some circumstance, it is referred to as a disruption and replanning is needed. The challenge is to find an appropriate level of planning where minor variations in conditions can be accommodated without requiring extensive revisions. A consequence of the peculiarities of the construction industry is that production planning also needs to take unpredictable events into account to mitigate further uncertainties in planning (Dallasega et al., 2021).

2.1.2 Rolling Wave Planning and the Last Planner System

Planning should not be viewed as a one-time activity but as an ongoing process that adapts to changing circumstances to maintain workflow reliability and to minimise disruptions (Ballard, 1999). It is necessary to plan continuously in order to avoid excessive problems when encountering various uncertainties (Dvir & Lechler, 2004). Continuous planning is therefore essential, especially in environments characterised by high levels of uncertainty such as the construction sector. Most contractors work with varying concepts of rolling wave planning with the purpose of obtaining concrete data for controlling production during a relatively short period (Hansson et al., 2021). Rolling wave planning is a planning method where the planning is continuously updated and extended forward in time, instead of making a fixed, detailed plan just once at the beginning of a project or period. The period for rolling wave planning is usually 10 working days or 14 calendar days and should have such a detailed division of activities that individuals can identify what they are going to do and

be involved in the planning process. The rolling plan that production management follows should be anchored at a planning meeting or similar. The following actors should be involved in anchoring these plans if they have not already been involved in the preparation process for them: site manager, supervisor, construction or project engineer, work manager, team base and affected work team during the coming period and affected subcontractors and side contractors during the coming period.

To further structure and improve the planning process at multiple levels, more comprehensive systems have been developed, one of the most well-known being the Last Planner System (LPS) (Kenley & Seppänen, 2010). LPS is a tool for production management that continuously monitors the efficiency of the construction process planning, it can be done physically or digitally. It is a system for planning and control, where the planning phase defines criteria for producing strategies and success and the control phase focuses on learning and re-planning by continuously ensuring events align with the plan (Kenley & Seppänen, 2010). LPS focuses on the formulation of the assignments and the person or group that formulates them (Hansson et al., 2021). That person or group is called "the last planner" since they are the last ones connected to that assignment and there is no more planning after them, just the direct work.

There are studies that show that using LPS correctly improves the performance of a project and increases productivity (Fuemana, Puolitaival, & Davies, 2013). Productive work planning is prioritised instead of using the time for "firefighting", since the ones executing the activities are continuously involved in updating the plan. Reducing construction time is possible when the planning is done in the earlier stages and this is done by involving all project participants in collaborative discussions as early as possible. With the use of LPS, the reliability between stakeholders is increased. LPS enhances collaboration and information sharing, reducing rework and improving the overall reliability of schedules (Dallasega et al., 2021). With the use of LPS one can identify and correct problems in early stages, also providing a systematic analysis for reasons of not completed activities.

The Last Planner System (LPS) is structured into several stages: Master schedule, Phase scheduling, Look-ahead planning, Weekly work planning, and a Learning stage (Kenley & Seppänen, 2010). The production phase primarily involves Look-ahead planning, Weekly planning, and the Learning stage.

Look-ahead planning details activities and events typically scheduled four to six weeks ahead (Kenley & Seppänen, 2010). Tasks are broken down into executable units and sequenced properly to facilitate communication and collaboration among responsible workers. This stage focuses on activities that can be ready within a few weeks and allows for replanning if necessary.

Weekly planning refines the schedule based on the look-ahead plan (Hansson et al., 2021; Kenley & Seppänen, 2010). Only activities with all prerequisites fulfilled are included, ensuring that commitments are realistic and achievable. Tasks that cannot be completed due to missing conditions are excluded (Lean Construction Institute,

n.d.).

The Learning stage consists of identifying and analysing failures and their root cause and it is a key component of LPS (Kenley & Seppänen, 2010). A key metric used in this stage is Percent Plan Complete (PPC) which is used to provide planning reliability and support continuous improvement process. It gives a value on the percentage of planned activities completed per week which provides a productivity measurement of the planning. When an activity is not completed as planned, a Reason for Non-Completion (RNC) must be provided to further analyse the underlying issues and to continue the work toward improvement. This method is used to find the root cause of the failure, such as which actor was involved, and to prevent it from happening again, improving forecasting in future projects.

2.1.3 The Role of the Supervisor and Site Manager

Management out in production in the Swedish construction sites mainly consists of the positions of site manager/production manager and supervisor (Hansson et al., 2021). The main task of the ones managing the production is to ensure that the project is carried out according to the agreed plans. This also includes reporting on deviations, if the work deviates from the plans, the person is obliged to inform other parties involved and the client about these.

The site manager or production manager is responsible for the production on the construction site and usually does this together with supervisors (Hansson et al., 2021). The site manager's duties include technology, contracts, leadership, finance, documentation, quality and environmental management, planning, purchasing of materials, meetings with the client, work management and work environment issues. They are also responsible for ensuring that the set project goal is met. The site manager is the person responsible for coordination within production and has the overall responsibility for time planning (Byggledarskap, 2023).

The supervisor role is closer to the production compared to the site manager (Hansson et al., 2021). The role of the supervisor can be categorised into three areas of activities: planning, preparation, and follow-up of construction workers' tasks (Alnervik & Jelacic, 2010). On smaller construction sites, a single site supervisor may be responsible for all tasks, whereas, on larger projects, responsibilities are typically distributed among multiple supervisors. It is crucial for site supervisors to plan ahead, stay informed about ongoing activities, and maintain a strong presence on-site. They should take a proactive approach, anticipating and addressing potential issues before they arise. This requires careful planning and thoughtful consideration of upcoming tasks. A structured and systematic approach is essential for being an effective supervisor. The supervisor is the link between the site office and production at the workplace. A supervisor's duties include preparing work, making deliveries, ordering resources, coordinating and reconciling both their own and subcontractors' various jobs. The supervisor is often in direct contact with the site manager and reports to them on how the daily work at the workplace is progressing (Byggledarskap, 2023).

2.2 Follow-up in the Production Phase of Construction Projects

Since planning is one of the most important activities when structuring the construction process it is important to have detailed and well-founded plans with clear milestones and to continuously follow up on these (Josephson & Saukkoriipi, 2009). To effectively evaluate whether the work is progressing according to the established plan or not it is essential to have clear ways of working with the right information on when, with what, and how tasks will be executed, to be able to control the production progress (Duarte-Vidal et al., 2021). Production follow-up mainly consists of collecting, monitoring and comparing the data with the planned expected outcome (Hansson et al., 2021). The work in the production phase is based on what was planned in the preparation process, but it is common for work to be changed, added or dropped. This means that schedules, budgets, production calculations and working methods must be followed up on in order to maintain control and for the plans to be up-to-date.

In a study done by Jonsson (2020), they identified several challenges associated with the follow-up process in construction production, such as the lack of sufficient time and resources available to carry out regular follow-ups. Competence and experience were also critical factors as well as employee engagement in order for the follow-up process to be successful. They also identified that the production schedule and cost estimate must align with the actual methods employed on-site to enable meaningful comparisons. The schedules used for production planning are usually constructed for bidding requirements instead of being created for the follow-up process, which prevent active support for coordinating the project during the production phase (Dallasega et al., 2021).

2.2.1 Traditional Methods

There are two main methods for working with follow-up in production (Alaloul, Alzubi, Malkawi, Al Salaheen, & Musarat, 2022). The first is the traditional approach, which relies on manual observations and statistical techniques to collect and analyse data related to various construction operations and resources. This method primarily involves comparing actual data with the expected outcomes outlined in the project plan (Hansson et al., 2021). Key components of this traditional method include monitoring financial performance, time schedules, deviations, inspections, and functional testing.

Financial performance is continuously tracked by the company management as they rely on continuous reporting from business and financial systems to effectively track the ongoing production (Hansson et al., 2021). It is important to continuously monitor that the project is developing economically as planned to make sure that the project is carried out in a sustainable way.

Time Schedules are managed by following established and confirmed plans, which

contractors must regularly monitor to ensure that the work progresses as intended (Hansson et al., 2021). Time management involves adjusting plans to handle disruptions and revising them as needed to meet deadlines despite changing circumstances. The general regulation is that the contractors report progress relative to the contract schedule upon the client's request, typically during construction meetings but potentially at other times if demanded.

Deviation Reporting occurs when production management identifies deviations from the plan and these deviations must be documented in a deviation report and sent to the responsible parties (Hansson et al., 2021). The report should detail the technical, time, and cost consequences of the deviation. Most companies use a standardised form and have routines for managing these reports. Throughout the project, all deviation reports and their statuses are compiled, regularly updated, and discussed in construction meetings.

Inspections and functional tests are an integral part of quality control, with inspection plans developed as part of the overall quality plan (Hansson et al., 2021). During the project execution, the contractor may initiate inspections of their own work as well as that of subcontractors to the extent deemed necessary, a process known as self-inspection within the contract. According to the construction contract and the inspection plan established by the building committee during the technical consultation, the contractor may be required to provide documented self-inspections. Additionally, inspections conducted by external parties may also be required and must be documented. As the building or facility nears completion, various functional tests are performed, most of which require formal documentation.

2.2.2 Digital and Automated Methods

The second follow-up methods are digital and automated which have a big potential for more effective construction control by automating data collection through digital follow-up methods in the production of projects (Kopsida, Brilakis, & Vela, 2015). The current most used follow-up methods in construction are the traditional ones which are done manually and take a lot of time (Turkan, Bosche, Haas, & Haas, 2012). Stakeholders often choose to use these methods since they are comfortable with and know how to work with them (Musarat, Khan, Alaloul, Blas, & Ayub, 2024). Due to the amount of work required for those daily or weekly tracking reports, the quality and accuracy of the actual progress can sometimes be affected, making the reports insufficient due to limitations of not being precise enough. As a result, these processes slow down the flow of information and can create inefficient decision-making (Alaloul et al., 2022). Automated methods use new technologies and artificial intelligence for monitoring construction operations. A possibility with automated follow-up is that it improves productivity through time savings and optimises budget savings (Rao et al., 2022). Late detection of imperfections and defects provides limited time to address potential schedule impacts which this counteracts (Omar & Nehdi, 2016). More precise follow-up processes and progress assessments allow for quicker adjustments out in production due to more accurate real-life tracking, as it is more representable of the current state (Duarte-Vidal et al., 2021). By enabling real-time monitoring

in follow-up processes, decision-making in the planning process can be improved through the collection of more accurate and timely data.

2.2.3 Usage of Previous Experience

Leveraging the knowledge and previous experiences is vital to improving the outcomes of future projects (Yap, Lim, Skitmore, & Gray, 2022). Not doing this in the follow-up process can lead to mistakes being repeated and a lack of learning from previous projects. Considering the number of assignments or projects each company carries out, there are clear opportunities for the company to develop efficient processes with minimal waste and strong profitability (Josephson & Saukkoriipi, 2009). However, the general perception is that the transfer of knowledge and experience between projects is limited. A reason for this is the project employees rush to the next project as soon as they finish one without summarising the most important lessons learned. Another reason is that companies have not succeeded in developing a systematic way of collecting, transferring, and applying the knowledge gained from all experiences. A common mistake is to create overly comprehensive systems for transferring experience. Overly complicated systems make it more difficult to systematically collect the good practices and new experiences gained in each project and use them in subsequent projects.

2.3 The Impact of Planning and Follow-Up on Productivity in Production

The purpose of all plans and controls is to strengthen the possibility of the project being carried out as planned (Hansson et al., 2021). To achieve this, it is essential to choose the appropriate methods and tools for follow-up as these contribute to improved productivity (Alaloul et al., 2022). However, in the presence of uncertainty and in the absence of proper control and follow-up during the project process, there is a risk of both under- and overestimations in planning. Without planning and following-up methodologies and proper measurement, it is impossible to work on productivity improvements (Bernolak, 1997). This is required to know where you are in the production process and to know what could be improved. This highlights the importance of maintaining accurate and frequently updated plans throughout the whole production phase (Dallasega et al., 2021). Follow-ups on the daily plans often show that only half of the planned activities are completed (Josephson & Saukkoriipi, 2009). This complicates the possibility of operating a production without having to improvise activities, creating a risk of wasting resources and time. More detailed plans reduce those risks and uncertainties, which reduces waste on several levels, making the processes more productive (Josephson & Saukkoriipi, 2009).

2.3.1 Tools and Measurements for Working with Productivity in Production

To support day-to-day and strategic decision-making in the planning process, there is a need to measure productivity on a project level (Forsythe, 2018). There are various methods and tools for measuring productivity in the production phase and with the appropriate tools, construction personnel can work with improving productivity themselves.

One way of working with productivity is to reduce waste, this is mostly about gaining an understanding of what activities in production are value-adding and what are not (Josephson & Saukkoriipi, 2009). To track how resources are being used, frequency studies are a tool which can be used to primarily monitor how people and machines are being utilised. The purpose of frequency studies is to produce a factual basis that makes waste visible in order to encourage improvements. Another tool is value flow analysis, in which a process is tracked over time by recording the minutes or hours spent, allowing identification of when and where value is actually added. After the tracking, the follow-up outcome is reported in a diagram where the proportion of value-adding time is calculated. This is followed by a closer analysis of the process to identify inefficiencies and determine which types of waste can be eliminated. To identify inefficiencies and determine which types of waste can be eliminated.

One way to measure productivity is with the use of PPC which is a part of the learning stage in LPS (Lean Construction Institute, n.d.). This is a method that is used on the project level which shows how many activities have been completed in total divided by the activities planned for each week. By doing this, one obtains a percentage of how many planned activities have been completed, which provides an indication of whether the right tasks are being carried out according to the plan. The traditional use of PPC has previously not taken into account how much work is actually performed in each activity (Elkherbawy, 2020). It also assumes that all activities are equal in importance. In a study done in 2017, they reviewed and provided an overview of the various metrics proposed in the literature on how to develop PPC and integrate more productivity aspects into account (El Samad, Hamzeh, & Emdanat, 2017). Their study highlights the fact that there are many metrics currently available on the market and new ones are as well being developed. Although their study shows this, only a few of them are actually used and well-studied or well-developed in practice. One of the new methods that takes productivity into account suggests adjusting PPC to weight each activity based on its actual amount of work and time spent (Elkherbawy, 2020). Instead of counting all activities as equally important, it takes into account that some tasks require more resources than others. This provides a more nuanced view of the project's progress and efficiency. By integrating productivity into PPC, project managers and teams might gain a better understanding of how effectively the work is being done. This method helps identify bottlenecks and improve planning to increase overall project efficiency.

2.4 Soft Aspects Affecting Planning and Follow-Up Processes in Production

In complex projects, soft aspects can sometimes be more important than technical ones when it comes to planning and control (Azim et al., 2010). Soft aspects highlight the importance of the "people", who are the ones performing the activities and managing the project. Some of the most important soft aspects related to people are leadership, teamwork and learning and development, emphasising the importance of a project's individuals.

2.4.1 Culture

According to Schein (2004) Culture is affected by the individuals within an organisation. The real culture exists in smaller groups, in this case, out in the projects. Since each project is considered unique and the project manager has a great deal of responsibility for how work is conducted within the project, the organisational culture does not hold as much significance. Instead, the real culture exists in the projects, which means that each project has a different culture depending on the leadership at the workplace (Schein, 2004). To create a culture that implements the company's values, these must be established in practice within the projects (Kiiskinen & Mared, 2021). A significant factor in achieving this is leadership. By motivating and coaching their subordinates, the leader plays a crucial role in fostering a positive project culture. Hansson et al. (2021) describe good leadership as characterised by openness, which lays the foundation for effective work, and clarity, which is essential for creating a positive and healthy work environment. Mutual trust and respect are fundamental and must be self-evident in all interactions. Teamwork is essential and the involvement of all team members is necessary to ensure shared commitment and responsibility.

In construction projects, new collaborations constantly arise between various actors, professional groups, and companies who come together around a common project for a limited period of time (Arbetsmiljöverket, 2025). Successful collaboration is crucial for the success of the project, in terms of quality, time, budget, and work environment. For collaboration to work effectively, responsibilities, roles, and tasks need to be clearly defined within each organisation. An important condition for a safe and well-functioning worksite is that everyone involved shares a clear understanding of what needs to be done, when it should be done, and how the work should be carried out in a safe and coordinated manner. Clear communication and a structured culture of collaboration are therefore central to the execution of a construction project.

Working in a more collaborative way among the members in a project has been proven to mitigate the risk of cost and time overruns (Löfgren, 2009). In projects with uncertainties, high levels of collaboration and trust within a project could lead to increased efficiency. It is argued that project members' cooperation, openness, and willingness to collaborate are fundamental to achieving high-level integration within teams (Kovacic & Filzmoser, 2014). Additionally, factors such as project

members' communication proficiency, and their ability to coordinate joint activities significantly influence collaboration within a project. Working according to LPS, collaborating with subcontractors who perform the activities and involving them in the planning process can increase planning reliability (Mcconaughy & Shirkey, 2013). Emphasising the importance of collaborating with subcontractors to achieve increased performance in a project.

2.4.2 Knowledge and Training

In recent years, the construction industry has been increasingly affected by a severe and widespread shortage of skilled labour, a trend observed across many countries (Nuwan, K.S Perera, & Dewagoda, 2021). In a study done by Jonsson (2020), there was uncertainty among employees on how planning and follow-up in production should be handled in a project. Without the proper knowledge of the work being planned, scheduling cannot succeed (AlNasseri & Aulin, 2015). Knowledge about planning and scheduling is a fundamental requirement for all organisations attempting to make planning methods and tools usable for managing their projects or systems. An incomplete planning process could diminish the value of schedules and, as a result, cause an uncontrolled progression of the project. Project planning is stated as a proactive step in order to detect and correct schedule deviations. Knowledge is required to understand how to conduct follow-ups effectively, and routines are typically developed through practical experience (Jonsson, 2020). Follow-up of the planning process cannot be achieved without the use of effective controls (AlNasseri & Aulin, 2015). A separation between the two processes may result in overlap and partial duplication when addressing resource constraints within the schedule. Planning and follow-up processes should not be viewed as separate, rather as processes that are used in combination.

To address the lack of skills, there is a clear need for training initiatives (Nuwan et al., 2021). In the field of development, employee training is believed to impact performance (Trost, Claus, & Herrmann, 2022). In addition, this area emphasises the necessity for employees to obtain appropriate skills through training measures in order to carry out specific tasks effectively. Providing employees with the required skills through training will not only enhance their performance but also benefit the organisation (Nuwan et al., 2021). In the study done by Nuwan et al, it was found that planning and schedule management are of high significance to construction managers. Moreover, they concluded that time management was the most significant skill to be successful, highlighting the importance of these competencies for managers working in the construction sector. Learning and training work differently between projects and seem to depend on project leadership, norms, and values (Hansson et al., 2021).

2.4.3 Social Sustainability

Social sustainability means taking responsibility for how a company impacts both society and its employees (HRnytt, 2024). It involves creating a fair, inclusive, and supportive work environment where everyone has equal rights and feels included.

Prioritising social sustainability ensures that employees have the conditions to work sustainably both physically and mentally over the long term within the organisation. In the construction industry, social sustainability is reflected in good planning and clear follow-up routines which contribute to a safe, predictable, and less stressful work environment. A clear daily work structure creates security for employees and improves both the work environment and collaboration on site. Neglecting social factors related to employees increases the risk of greater physical and mental strain (Trost et al., 2022). This can result in reduced performance, lower productivity and decreasing employee satisfaction.

Training and competence development are essential components. When employees feel confident in their knowledge and skills, the quality of work improves and job satisfaction increases (HRnytt, 2024). By investing in education and measuring social performance, organisations can further enhance the work environment and retain healthy, motivated employees who thrive and develop over time. Construction supervisors play a key role in fostering social sustainability by ensuring clear communication, supporting skill development, and maintaining a structured and safe working environment. Their leadership directly influences the team's ability to collaborate effectively and work sustainably throughout the project.

Work environment is not only about physical risks, but also about culture, leadership, and the ability to perform quality work. When employees feel that they are not given the conditions to deliver quality, ethical dilemmas often arise. Over time, this negatively affects motivation, engagement, and ultimately productivity. Without a healthy work environment and a positive culture within projects, it becomes difficult to achieve strong results, regardless of how well-planned the activities are (Ledarna, 2024). There needs to be a strategic-level understanding that a good work environment is not something secondary but a fundamental prerequisite for achieving high productivity. A socially sustainable work environment is not a variable that can be adjusted as needed, it should rather form the foundation for long-term efficiency and quality in work (Ledarna, 2024).

3

Methods

This chapter presents the methodological approach used to achieve the aim of the study and to answer the research questions. It further covers the chosen research design and the strategies employed for collecting and analysing the empirical data. It also includes the chosen research approach, research design, and data collection methods, as well as considerations regarding the trustworthiness and ethics of the study.

3.1 Research approach

This study adopted a qualitative research approach as it allowed for a deeper understanding of industry professionals' experiences and perspectives, which could not have been captured through purely quantitative measures (Bell, Harley, & Bryman, 2022). The research followed an abductive approach, where empirical observations and theoretical insights were continuously refined. Initially, existing theories on productivity follow-up provided a foundation, but as data collection progressed, new perspectives emerged, shaping the study iteratively. As interviews were conducted, emerging themes guided further questioning, ensuring a flexible and responsive approach to the study's focus. The study further adopted an interpretive research philosophy as the aim was to understand social phenomena through individuals' own experiences and interpretations (Norman K Denzin & Yvonna S Lincoln, 2018). Qualitative research within interpretivism is used to make sense of or interpret social or human phenomena and the focus lies in studying these phenomena in their natural settings and understanding them based on the meanings people themselves assign to them.

3.2 Research design

A case study approach was chosen for this research as it allowed for an in-depth exploration of real-world practices on how planning and follow-up are conducted in production. The case study included two ongoing building construction projects from a company active in the Swedish construction and civil engineering industry. The company is one of the leading construction companies in Sweden and their operations include building and infrastructure projects, production of asphalt and

stone materials, as well as commercial property development. The chosen projects are from their building department and were selected for their relevance to the topic. The selection of projects has also been guided by the availability of ongoing projects within the company at the present time. A case study approach is particularly beneficial in this context, as it enables a nuanced understanding of the factors influencing project success (Bell et al., 2022). The findings from these projects will contribute to a broader understanding of how planning and follow-up impact the projects and productivity within them. The different levels of planning that were covered in the case study in the studied projects can be seen in Figure 3.1.

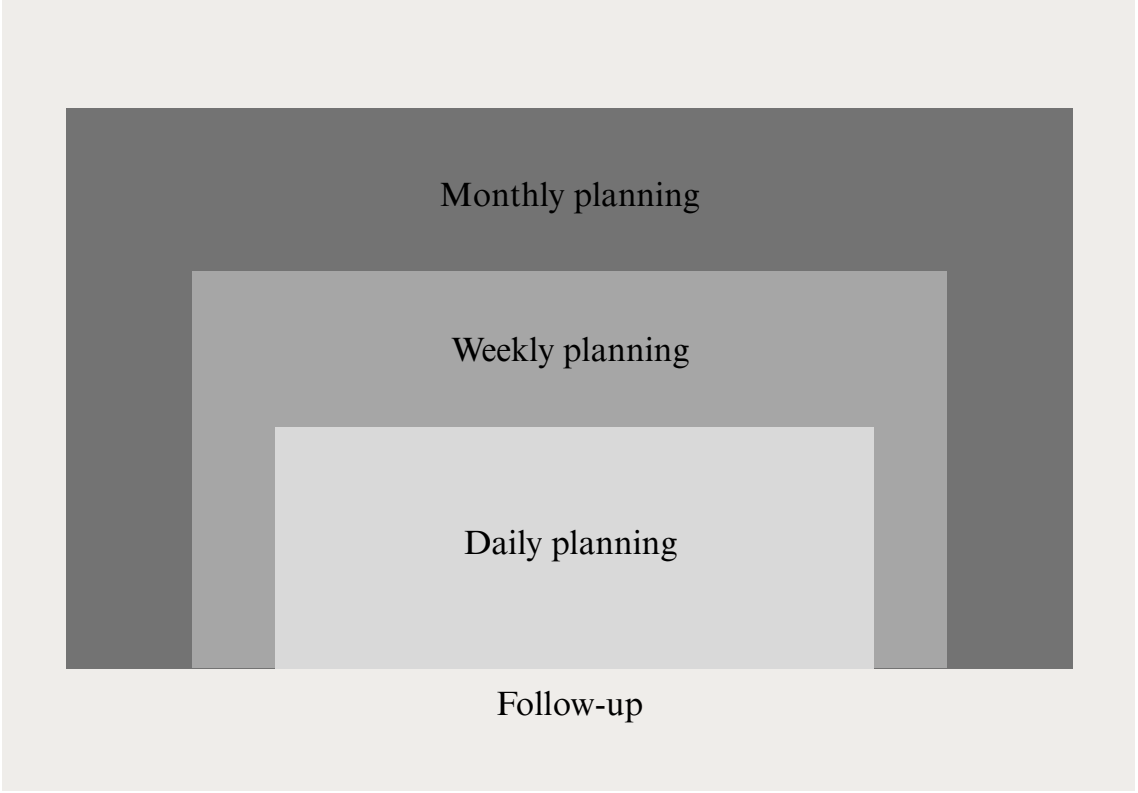

Figure 3.1: Overview of the planning levels in the production phase and how they are interrelated.

The first project, referred to as Project A throughout this study, consists of the construction of a new school designed to accommodate 600 students with an area of approximately 9,000 square meters (Company website A). The school consists of three buildings and includes a sports hall. The project has a total budget of approximately 260 million SEK and the duration of the project is 2–3 years with the start in 2023 and the estimated finish time is for the school to be ready for the start of school in the fall of 2025. The management in production consists of one site manager and two supervisors which can be seen in Figure 3.2. The first project was chosen because its rolling wave planning process was said to be highly effective, making it an interesting and good project to examine, a strong reference point that shows how rolling wave planning can be executed.

Figure 3.2: A description of the management structure in Project A.

The second project, referred to as Project B throughout this study, is a large-scale development area that includes new construction, renovation, and expansion with an area of approximately 45,000 square meters (Company website B). The project involves building offices and commercial spaces, with a budget of 1.2 billion SEK and a duration of 3 years from 2022–2025. The management in production consists of 7 block managers and 16 supervisors and can be seen in Figure 3.3. The second project was chosen due to its complexity and the many roles involved in the management of the project. It was also chosen in order to provide broader perspectives and enable comparisons both within the project between the blocks and with Project A.

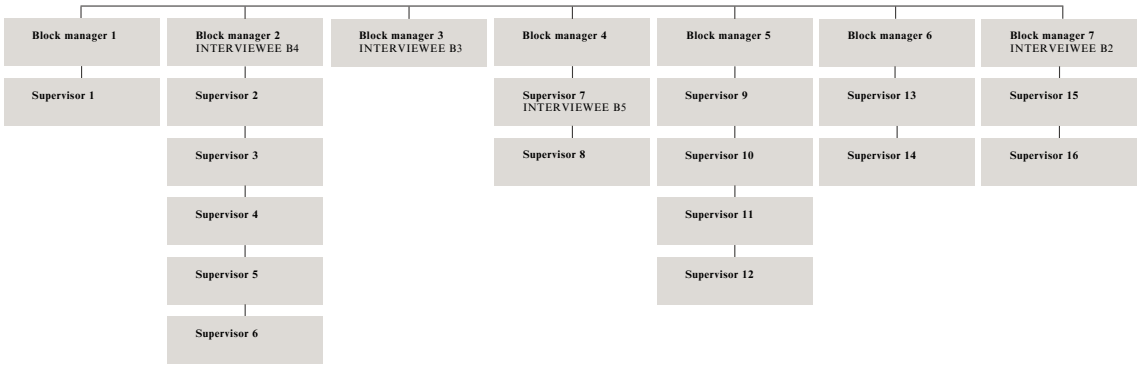

Figure 3.3: A description of the management structure in Project B.

3.3 Data Collection

Semi-structured interviews formed the basis of the data collection for the study, allowing for a structured yet flexible approach (Bell et al., 2022). The interviews included both predetermined and open-ended questions. The predetermined questions provided a fundamental understanding of the topic, while the open-ended questions enabled deeper exploration and allowed respondents to elaborate on aspects they deemed important. This method facilitated an open dialogue while maintaining a consistent framework across all interviews. The interview guide with the semi-structured questions used for the study is available in the Appendix. Appendix A was used for the supervisors and site managers, Appendix B was used for the researcher and professor. Most of the interviews were conducted in Swedish, as this was preferred by both the interviewer and the interviewees to avoid language-related misunderstandings. The interviews took place either via Teams or on-site. Participants were informed about the purpose of the research and given the topics

in advance to allow for more reflective responses. Verbal consent was obtained from all interviewees for audio recording, and the recordings were transcribed. The transcriptions were used solely for research purposes and deleted after the study was completed. In some cases, interviewees were contacted again to clarify or expand upon specific topics that emerged during the analysis.

3.3.1 Interview Participants and Selection Process

The interview study was conducted with a total of 12 participants, all of whom had experience with planning and follow-up. The information regarding the interviews can be seen in Table 3.1, for consistency throughout the study interviewees are referred to as either Interviewee A1-A3, Interviewee B1-B5 if they are working in one of the projects in the study or Interviewee C, D, E and F if they're not working in either of the projects.

The chosen participants were individuals with different roles working within the studied projects, as well as a professor and a researcher within the field. The interviewees were selected based on their direct involvement in the construction project management, ensuring they had firsthand knowledge relevant to the study's focus. The selection of interviewees was designed to capture multiple perspectives on planning and follow-up within their projects. Their roles included project managers, site managers, and supervisors. In addition to interviewing the individuals directly involved in the projects, interviews were also conducted with individuals in higher management positions responsible for strategic planning and process development. This provided a broader view of how planning and follow-up are perceived at both the operational and organisational levels, which allowed for an analysis of potential discrepancies between planned strategies and practical implementation. Furthermore, the researcher and professor on the topic were chosen as interviewees for additional perspectives on the same topic and to get a more nuanced look from other actors outside the company. They are both experienced in the topics of planning, follow-up and productivity in production which was the reason as to why they were chosen for the interviews.

Throughout the research process, continuous communication with the supervisor from the company (Interviewee F) has been maintained through regular meetings and discussions. They have provided support, guidance and adaptation in the research throughout the whole process. It has also helped to gain a deeper understanding of how the study fits within the broader context of the company and the industry. Communication with them occurred frequently but no specific interview duration has been recorded, unlike the other interviewees for whom such information is available.

Table 3.1: A complete list of interviewees, which project they are connected to, their roles and the conditions of the interview

PROJECT	INTERVIEWEE	ROLE	DURATION OF INTERVIEW	CONDITIONS FOR INTERVIEW
A	INTERVIEWEE A1	SITE MANAGER	120 MIN	ON-SITE
A	INTERVIEWEE A2	SUPERVISOR	30 MIN	TEAMS
A	INTERVIEWEE A3	SUPERVISOR	45 MIN	TEAMS
B	INTERVIEWEE B1	PROJECT MANAGER TIME PLANNING	50 MIN	ON-SITE
B	INTERVIEWEE B2	BLOCK MANAGER	90 MIN	ON-SITE
B	INTERVIEWEE B3	BLOCK MANAGER	90 MIN	ON-SITE
B	INTERVIEWEE B4	BLOCK MANAGER	45 MIN	ON-SITE
B	INTERVIEWEE B5	SUPERVISOR	80 MIN	ON-SITE & TEAMS
-	INTERVIEWEE C	RESEARCHER	60 MIN	ON-SITE
-	INTERVIEWEE D	ASSOCIATE PROFESSOR	65 MIN	ON-SITE
-	INTERVIEWEE E	PROJECT MANAGEMENT SPECIALIST TIME PLANNING	90 MIN	ON-SITE
-	INTERVIEWEE F	SENIOR LEAD SPECIALIST	-	ON-SITE & TEAMS

3.4 Data Analysis

The collected interview data were analysed using thematic analysis, a method for identifying patterns and themes in qualitative data (Bell et al., 2022). This approach was chosen for its ability to provide a structured yet flexible framework, allowing for a deeper understanding of planning, follow-up and productivity in construction projects. Furthermore, the Affinity-Interrelationship Method (AIM) was used which is a problem-solving tool for analysing qualitative data. This was used to structure the data in a visual and easily understandable way. The method also contributed to a deeper understanding of the relationships between the different themes (Alänge, 2009).

All interviews were recorded and supplemented with supporting notes. The recordings

facilitated transcription and formed the basis for the analysis and selected quotes. A first draft was generated using a speech-to-text tool in Word for the interviews conducted on-site, while for the Teams interviews, the built-in transcription function was used. After the initial transcription, all transcriptions were manually reviewed and refined to correct any errors or misinterpretations. The recordings were played back several times, with frequent pauses and rewinds to ensure the accuracy of the transcriptions.

Once the transcripts were complete, they served as the basis for the thematic analysis. The interview data were initially examined by extracting key findings and documenting reflections and recommendations that emerged both during the interviews and the analysis process. Using a colour-coding system, similar concepts were grouped into broader categories based on the three recurring themes related to planning, follow-up, and productivity. This categorisation helped structure the data in a systematic way. After completing the thematic analysis, AIM mapping was applied to visualise and organise the data further, allowing for a clearer representation of relationships and prioritisation of key factors. This structured approach ensured that the insights captured were not only reflective of individual perspectives but also highlighted overarching trends within the collected data.

Throughout the process, theoretical frameworks were continuously revisited in an iterative interplay between theory and empirical findings (Dubois & Gadde, 2002). The analysis evolved dynamically, refining existing frameworks rather than generating entirely new theories. This abductive approach was particularly valuable in case-based research as it allowed for the discovery of new insights and relationships grounded in the complexities of real-world construction project management.

3.5 Ethics and Trustworthiness of the Study

Throughout all stages of the research process, measures were taken to protect the identity and privacy of the interviewees and to obtain consent to use their information in the study. The company and all the individuals interviewed are anonymous and are only mentioned in terms of their profession within the organisation. The interviews were recorded with the permission of the interviewees and the recordings were used only by the authors and were not shared in any way. To ensure objectivity, the researchers maintained a neutral stance throughout the data collection and analysis process to mitigate potential biases.

Recording interviews carries certain risks, such as respondents feeling nervous or hesitant to fully express their opinions when being recorded (Eklund, 2012). To mitigate this, each participant was asked for consent before recording and was informed that the recordings were solely intended to facilitate data collection, encouraging a safe environment for an open discussion. Further, all participants were given the topics beforehand to have an understanding of what was expected from them and they were also fully briefed on the purpose of the research.

The study's trustworthiness was assessed based on the four criteria: credibility, transferability, dependability, and confirmability (Bell et al., 2022). Credibility was strengthened through participant validation and careful data handling. To ensure the credibility of the findings, participants were given the opportunity to review and provide feedback on the collected data and interpretations, allowing them to verify their accuracy. Transferability was considered by providing detailed descriptions of the study context, allowing for potential applicability in similar settings. Throughout the data collection process, the authors maintained a critical approach to enhance the quality and reliability of the study. Dependability was ensured by maintaining a systematic and transparent research process, while confirmability was addressed by minimising researcher bias and ensuring that conclusions were grounded in the collected data.

Throughout the research process, the supervisor from the company played a crucial role in validating the findings by providing industry insights and ensuring that interpretations aligned with practical applications within the company, which further contributed to the trustworthiness of the study. The regular discussions and feedback sessions with the supervisor have helped to refine the analysis, confirm the relevance of the results, and gain a deeper understanding of the organisational context.

3.6 Use of AI

AI, in the format of ChatGPT, has been used to translate sentences and words between Swedish and English in the report. AI was also used to check the grammatical structure of the study and find proper synonyms to achieve a more formal language throughout the whole report.

3.7 Reflection on the Method

At the beginning of the work when the focus was to get acquainted with the subject, the expectation was that the case study would have a greater focus on productivity and how to increase it in the projects. The expectation was that it would be possible to further look at value-adding activities and how to work with follow-up in order to be able to optimise productivity further. During the first interviews, the focus shifted, and it became much more relevant to look at the actual execution of planning and follow-up since productivity was hardly known or checked, which made the study take a different direction than the first expectation. Hence the abductive approach was needed to go back and forth between literature and findings, and they were shaped dependent on each other. Despite the differences in how the literature described how to conduct things, it has been interesting to observe how the studied projects have managed to make their processes work in practice, often by adapting methods to local conditions and through informal solutions. It was further interesting to have the perspectives from the other actors outside the company which contributed with more perspectives but also overlapping thoughts and similarities to what the interviewees from the company said.

4

Results from the Interviews

This chapter presents and interprets the information gathered from interviews and data collection. The purpose is to provide practical insights into the research questions by highlighting the experiences, perspectives, and routines of actors involved in the production. The structure of this chapter follows a similar structure as presented in the Literature Overview, beginning with production planning, followed by follow-up, and concluding with the productivity connected to those processes.

4.1 Planning in Production

The first section in this chapter covers how the planning process is carried out in the two studied projects, highlighting differences between them and their approach to planning. It then explores the interviewees opinions on how requirements and guidelines affect the project. This is followed by how collaboration affects the planning process during production, and the varying levels of knowledge and priority placed on planning. Finally, it covers how company culture influences planning practices and project culture.

4.1.1 The Current Way of Working with Production Planning in the Studied Projects

In Project A, the site manager has established a clear structure for how the planning process is carried out, which is perceived similarly by the supervisors. Interviewee A1 described the entire process from the digital production plan down to daily planning, following a structured approach that includes phase planning, a 10-week plan, a 3-week plan, and a 1-week plan, where each day is detailed with post-it notes. Interviewee A1 explained that their approach to rolling wave planning is based on the Last Planner System (LPS) but without the follow-up component. According to Interviewees A1, A2, and A3, the methods and tools used throughout the project have remained consistent. They all agreed that the division of responsibilities between the site manager and supervisors has been effective and stable from the project's start until now. Interviewee A2 highlighted that this structured way of working made it easy to step into each other's roles and support one another since everyone was well

informed and knew what needed to be done due to good coordination in planning. It also made the onboarding of new team members easy and quick, enabling them to quickly adapt to the project's workflow, even if they had limited experience in the role.

In contrast to Project A, planning in Project B varied between the seven blocks and there was no common, structured and consistent way of working. The block managers worked with planning in their own way with little to no collaboration with the other blocks. Methods and tools used have changed over time, much due to differences in the way of working and no existing standard, which has resulted in difficulties when switching roles between the blocks in Project B. Interviewee B2 felt and described the situation as "*everyone runs their own race*" and that every block works with planning in their own way and that there is poor planning between the blocks. Interviewee B3, who has switched between two different blocks, explained that people use different ways of documentation for planning and that they have tried different methods based on the different needs throughout the project. Other than the digital planning for the whole project, there are no standardised templates on how to document the planning, leading them to have to test by themselves in different ways by creating their own Excel files. Since Interviewee B4 came into the project midway and became block manager, the planning process in their block has been improved by them deciding to scrap all other methods and that they must work in one common way. Planning between the blocks has also been improved since the understanding that blocks have to plan and work together has started to sink in much due to their prioritising on it in that block. Since they incorporated this perspective, everyone involved in the planning process have started to see the consequences of planning not being an important factor.

Another issue that was raised by some interviewees in Project B, other than using different tools and methods for planning, was that all activities that were to happen in the project were not even in the plan. Both Interviewee B2 and B5 complained that too many people did not plan ahead and only focused on "putting out fires" in their daily work. Interviewee B2 said that there had been occasions of bad foresight between the blocks, where people asking for something only minutes before it's needed instead of 2-3 weeks ahead, making it harder for some blocks to plan their activities. This way of working created a chaotic planning environment and bad foresight for everyone involved. Interviewee B3 said that one of the reasons for ending up in this situation was due to them being understaffed. They also highlighted that too little time was prioritised for planning and coordination in their schedule as block managers. This was also a consequence of their situation of being set back in the planning and that the meetings that were supposed to be for planning were instead used to "put out ongoing fires" from previous weeks. The issue with bad foresight and not having all the activities in the plan was explained by Interviewee B1 as due to individual differences. Their opinion was that some are simply better at planning and having foresight, while others struggle more. Related to these individual differences, interviewees B1 and B3 deemed that the project's complexity was one of the reasons as to why planning was complicated for them in this project.

4.1.2 Usage of Requirements and Guidelines on Project Level

The interviewees from the two studied projects think there is a lack of guidelines and requirements from the company on a project level. They think that stricter guidelines and requirements are needed, preferably at the beginning of the project, to set a clear structure. Interviewee B4 highlighted the importance of establishing clear structures and providing the right conditions from the very beginning of a project. The consequence of that resulted in varying conditions between projects, which was noted by many of the interviewees out in the projects and highlighted by Interviewee E. Interviewee E also said that they feel that "*the current level of freedom as of now is making it hard to push people into having a consistent approach*" since there are varying conditions between projects, further stating that "*You will find as many methods as people you interview*". Interviewee B5 mentioned that they have tried to implement a digital way of working with LPS in Project B, at the request of the workers on-site as they felt it necessary to change their current way of working with planning. This implementation did not work out since all supervisors did not take responsibility and plan in that program which made it useless. The plan was also to involve the subcontractors further in the process when it was up and fully working with the supervisors but it did not get to that point.

Interviewee F explained that company guidelines exist and that they mandate the use of LPS for planning from six-month planning down to daily planning. They also said that the execution and choice of tools are not regulated and as a result, each project can determine its own approach which can be seen from the other interviewees' thoughts. Interviewee F explained that at the beginning of a project, a decision should be made on how areas of responsibilities for each role are divided and what type of meeting structure regarding planning will be applied for the whole project. The general thought from the interviewees out in the projects was that it should be possible to decide which planning approach to implement on a project level. They also believed the chosen approach should then be a must to work with for the whole process and make everyone work with it. According to Interviewee F, this is already the case and how it is supposed to be.

The lack of requirements and guidelines was also mentioned by Interviewees C and D. They stated that there are no strict requirements within the construction sector and that it often comes down to the individual level on how one works with planning which leads to many different ways of working. With requirements and guidelines, one can implement a common way of working. They further said that it is hard to implement a standard for the whole industry, but there should be a structure and standardisation to work in the same way within a project.

4.1.3 Collaboration in the Planning Process in Production

The interviews revealed that collaboration in projects is influenced by several factors, including the level of ownership and accountability, the extent of involvement from different parties, and the overall structure of collaboration in the project. Interviewee C explained that to succeed with the planning process, collaboration is of great importance and "*The key is that everyone is responsible for their activities*". It is necessary to involve the people who carry out the activities in the planning process. By planning together with all trade groups and subcontractors in a project and involving them, a feeling of solving things together can be accomplished which leads them to take responsibility for their activities. According to Interviewees C and D, when doing monthly and weekly plans there should be high involvement with the people executing the activities. They continued with the idea that the use of LPS, as a planning approach, can create a common understanding and get everyone to work in the same way which facilitates collaboration.

The interviewees from Project A shared that they worked in a collaborative approach in the planning process. Interviewee A1 narrated how the meetings were structured during the course of the project, three meetings were always scheduled each week for planning. In the first meeting on Mondays, the site manager and the supervisors went through the planning for the next three weeks together with a representative from each trade group and subcontractor. All trade workers were responsible for their own post-it notes, based on the last planner principles, and they reviewed which activities could be carried out and which unfinished activities from the previous week would be carried over to the next week. Then there are two meetings on Thursdays, one with the administrative staff and one with the tradespeople. In every meeting, there was at least one representative from each trade group involved in the upcoming tasks to avoid misunderstandings. Since the trade groups put up their own post-it notes, it made them more engaged in planning and improved the feeling of ownership. Interviewee A2 expressed that "*the planning has gone very well and there have not been any complaints from the subcontractors about the approach*". They believe that it is because they have been highly involved in the planning, which has led to good collaboration within the project.

The visual accessibility was one difference between the two projects that were noted during the interviews. In Project A, they worked a lot with having the plan visible and accessible on-site. Interviewee A2 said that everyone could access the 10-week plan and they also had the planning for which areas and entrances were currently available and which were currently occupied. They also had a post-it notes plan in the lunchroom where everyone at any time could write questions and considerations regarding the plan that were then later brought up in the next meeting. This was not the case for Project B, as all of the interviewees explained that there were no visual plans available in the project.

Project B contained a more varied view of the planning process compared to Project A. The interviewees working in Project B said that the meetings that occurred continuously throughout the project process were between the block managers and between block managers and their supervisors. There are also meetings between all the supervisors on site, as well as meetings with their corresponding subcontractors. The interviewees had regular meetings to review their tasks, as the subcontractors weren't involved in the initial planning process in some blocks, only being engaged in production planning. Interviewee B1 highlighted the importance of communication between the blocks and emphasised that subsequent activities must follow up with previous ones to check their progress and ensure they finish the necessary tasks on time. This ensures that there is alignment and that each block can properly coordinate their work with the others, however they struggled with this in some blocks. Interviewee B3 confirmed this and said that there have been occasions when they do not know what other blocks are working on. An exception from this was the block that Interviewee B4 worked in, they explained that they did the plan themselves in the beginning with Interviewee B1. Then when an initial plan has been established they involve the subcontractors. They explained why they involved them in the later stage was because they can easily become fussy and set too long buffer times otherwise. After Interviewee B4 came into the project and promoted a shared approach to planning, it enabled better collaboration with other site managers. In their block planning meetings are now done on a weekly basis which they believe should be implemented across all blocks due to the positive results it has brought.

4.1.4 Varying Level of Knowledge and Priority on Project Planning

When looking at the overall knowledge regarding planning processes in production in the construction sector, Interviewee C expressed that there is a general lack of it, not just in these projects and this company, but across the whole construction sector. Interviewee D described that challenges regarding planning in production primarily exist due to varying knowledge levels, and communication skills due to them not understanding what they are discussing. Interviewee D also highlighted that acquiring a good knowledge level and staying at the forefront of competence is an organisational issue and not on a project level. It is particularly essential for those working with production planning.

According to Interviewee F, there are different ways to work with planning and what it implies depends on which role one has in the project. Some individuals primarily need to be able to follow a plan, others are mainly responsible for creating it, and some must be capable of both. Even though planning responsibilities vary between roles, it is essential that everyone understands the overall planning process and how the different levels of daily, monthly and higher plans are connected and affect each other. Similarly, Interviewees C and D express the importance of knowing and understanding how each level of planning is interconnected in production, where

each step should be developed with consideration of the others. When making a monthly plan, it is crucial to also keep the overall plan and the weekly plan in mind. Similarly, the weekly plan must align with both the monthly and daily plans. At the daily level, all previous plans should be clear to ensure that the work can be executed effectively.

An indication of the varying levels of knowledge and prioritisation on planning in the projects, according to the interviewees, was the limited prerequisites and training provided by the company. Supervisors are required to have a 4-week plan and use rolling wave planning, yet there is little guidance on how it should be done. Interviewee A3 and B5 noted that there is little to no training at the start of projects or support with rolling wave planning. They both believed that, as a supervisor, one should learn from the site manager above, helping to create a culture within the company where a good site manager develops good supervisors. Interviewee B1 said that there is not enough time for supervisors to learn solely through the site managers' own experiences as it was done before. The role of the supervisor has become more administrative, which they say also might contribute to the loss of planning culture due to less time being available to learn from the site managers.

Further, Interviewee B1 and E stated that planning is something that needs to be learned through experience and over time, highlighting that there are too few employees with sufficient planning knowledge. Interviewees A3 and B5 also observed that there are different levels of planning knowledge among the colleagues in the projects. While some are skilled at it, there are also many who primarily focus their work on "putting out fires". Interviewee B1 agrees with that and said that "*A good site manager often starts as a skilled work supervisor and can then train new supervisors*". However, if the site manager lacks insight into planning, it becomes difficult to engage the supervisors in the process. Within this topic, Interviewee F raised questions about what factors and personal qualities it is that affects and decides on which type of planner one becomes. How much does knowledge, leadership and soft aspects matter and affect whether one becomes a "firefighter", a "strategic planner" or something in between.

Interviewee B4 noted, when they started working in Project B, that planning was not prioritised and explained that many didn't understand the importance of planning in production. This was highlighted when they wanted to implement more meetings. In the beginning, the workers didn't comprehend why they needed that which led Interviewee B4 to have to explain why following the schedule is of big importance. However, after understanding the importance, in combination with a clear and structured plan in place to follow, they felt that the subcontractors tended to perform better, not only in terms of productivity but also from a socio-psychological perspective. According to Interviewee B4, "*it made them feel more stable, and enjoy their work more*" which caused the overall culture and atmosphere in the projects to be improved.

4.1.5 Planning Culture

The interviewees shared a common view on how the overall culture and priority regarding planning is lacking in the company and not only on the project level. One way this became evident, according to Interviewee B1 and E, was through the shortage of employees working with planning within the company. They believed that there are too few people that are interested in or currently working with planning, and that there should be more roles dedicated to it. They further stated that "*there is no real "planning culture" within the company*". They explained culture in this context as: the company doesn't push and prioritise it or set clear guidelines and requirements for the employees on what planning implies for them.

Interviewee B4 shared the view that there is no good planning culture but stated that this is a problem within the whole construction industry and not only this company. According to them, this is because there are a lot of people who do not know how to work with planning which is a company issue regarding knowledge. Interviewee D states that planning culture does exist but that the reality and outcome of projects fall below the expectations from the companies, saying that people are planning but not to the degree that is being wished for. Interviewee B1 said that they have noted different levels of knowledge and think that this is due to a lack of habit and something that has faded within the company due to a lack of emphasis and pressure on proper planning. When it comes to priorities in the company, Interviewee B1 mentioned that they felt that the company has focused more on other things, such as digitalisation and different systems, rather than planning and training the people in the projects. They saw this as a big issue and explained, "*If the people out on-site don't know how to work with planning from the start, why focus on different systems and tools instead of addressing the fundamental issue that people lack the right knowledge*".

The interviewees from Project A shared that there was a lot of commitment from the people involved on the construction site since they all planned together. As a result of the people who were going to perform the work were involved in the planning, they naturally took responsibility for their own tasks. In contrast, Interviewee B1 from Project B highlighted that they felt that there was a lack of ownership from supervisors and block managers regarding planning and that it was shown in the way it was executed. Interviewee B4 has a lot of experience working as both site manager and project manager and explained that they always have a strong focus on planning, which they noticed wasn't the case in Project B when they came into the project. Since Interviewee B4 joined Project B midway, they have focused on making the supervisors understand the central role that planning has and emphasised that it should always serve as the constant basis for all the daily work.

The interviewees out in the projects felt like the time specialists were doing the work for people rather than teaching them how to do it themselves. Interviewee B4 highlighted that supervisors and block managers should be able to perform that

work themselves. Interviewee E mentioned that they experience that people work very differently in projects, and due to these differences, they find it hard to support them. Interviewee E also observed that people were hesitant to work in the digital planning programs, a concern that Interviewee B2 also mentioned in their interview, stating that they "*did not want to go in there and mess things up*". Instead, they said that the project planner did it for them.

Interviewee B4 advocates for clear company-wide guidelines regarding planning practices to support a stronger planning culture. According to them, a common excuse for poor planning is a lack of time, however, they argue that the issue is more often a matter of wrong priorities. Interviewee B1 thinks that in an individual approach to planning, there is a need to shift from simply working with the resources at hand, as they perceive to be in the present, towards a mindset of planning for what needs to be done. Interviewee B1 and B4 think that to be able to create a better planning culture within the company, the company first needs to invest time and resources into training their employees with basic planning knowledge. Then they need to prioritise planning for a few years in order to see the effect of more employees gaining the knowledge and starting to teach each other.

4.2 Follow-up in Production

This section of the chapter covers follow-up methods in production in the two studied projects, highlighting what methods they are using. It is then followed by an exploration of how they make use of previous experiences from the company and areas for possible improvements. Lastly, it covers challenges that affect the follow-up methods such as the cost estimate different focuses.

4.2.1 Follow-up Methods Used in the Two Studied Projects

According to the interviewees from Project A, the follow-up methods mainly consisted of performing self-checks to ensure that no rework would be necessary. The interviewees also explained that they walked around the construction site to visually ensure that everything appeared in order. In addition, random checks were conducted on the self-inspections of critical steps. When following up on the planning it is either done through meetings or on-site discussions to estimate the percentage of progress made and compare it with the schedule. Furthermore, the interviewees mentioned that there is also a deviation requirement to document a least one deviation per month, but the supervisors explained that this was only used for the major deviations. Interviewee A1 also presented a bar chart of how they tracked the main activities and milestones in the project. The bar chart showed different categories such as time, economy and accidents, and a percentage representing the progress in the different categories based on the goals set at the beginning of the project. They also documented the progress for each activity in an Excel file as a reconciliation to see if

the schedule was followed. In the file, they also looked at the forecast for time and money for what each activity will end up with.

In Project B they had a similar way of working with follow-up to Project A as they worked with self-inspections on-site and control rounds to see if everything worked well. Direct planning review happened every third week in the form of a meeting where all activities in the timeline were discussed between the block managers. Interviewee B2 indicated that there was no follow-up to some of their activities as most of them were not in the plan from the beginning. Interviewee B4 worked with follow-up by reviewing each activity and task every morning. They check with their supervisor whether there are enough resources to carry out the activities planned, explaining that since that's the first thing that can go wrong it is very important. When things aren't right, they want reports to be able to solve the problem as quickly as possible. Interviewee B4 also pushed their supervisors to work with economic follow-up. For example, making a new forecast all the time as soon as they receive an invoice, to directly see how it affects and how things are going according to one's planning and budget. Interviewee B4 explained that as soon as someone starts to fall behind the schedule, they are expected to develop an action plan to get back on track. They are given a maximum of two days to prepare the plan and present their proposed solution.

An issue that was brought up in interviews from both projects was problems with following up on subcontractors' work since they often don't want to say that they are 100 percent done. Interviewee A3 explained that this was because the subcontractors wanted to have some extra time to be able to make adjustments if needed. Another reason for it being hard to follow up on the subcontractors could be because they are not keeping track of their own work correctly. Either they are checking off too little work, or they haven't done what they should and are billing too many hours. These things make monitoring subcontractors tougher than the usual follow-up on their own work in the projects.

Both projects worked with LPS but not the learning part which includes Percent Plan Complete (PPC) and Reason for Non-Completion (RNC). Interviewee A1 explained that they did not use those in Project A because they felt that the focus in previous projects that they have worked in, shifted from completing the most important tasks to simply achieving a good percentage. Interviewee A1 also pointed out a potential risk with PPC which was that it tended to prioritise creating a good plan over focusing on the critical activities that need to be completed. As a result, the data gathered from PPC may not always be highly reliable and useful for the project, hence their decision to not use it. Regarding RNC, the interviewees from both projects highlighted that they didn't work with this. When deviations occurred, instead of looking at the reasons as to why they happened, the focus was on fixing them to be able to finish within the end time. This was the current way of working with deviations in both of the projects. Only major ones that affect the budget or completion time were documented. Minor deviations in the projects were rarely

documented as it was considered time-consuming and not particularly beneficial.

Interviewee C feels that the main focus when it comes to follow-up should be on deviations. A lot of focus is placed on other things, but it is the deviations that lead to delays. They believe more emphasis should be placed on identifying the reasons behind these deviations and finding ways to prevent them from recurring in the future rather than focusing only on how to move forward. Interviewee D agreed about having the focus on deviations but highlighted that planning can sometimes go wrong without having deviations simply because there is a lack of clarity on progress. They thought that the focus should not only be on variations in the plan but also on maintaining consistency. Without consistency, there may be no obvious deviations, yet the project can still lose direction. Interviewee D also feels that when deviations occur, they are the result of multiple issues that have already taken place, ultimately leading to delays. Therefore, deviations should be seen as the final consequence of earlier problems rather than isolated incidents.

4.2.2 Usage of Previous Knowledge

One common point of agreement among the interviewees was that there was no time to review lessons learned from other projects within the company to apply in their current work. Instead, the interviewees who worked in the studied projects explained that they primarily relied on their own experiences gathered from previous projects. Interviewee C highlighted a vulnerability in this approach, noting that experience is often limited to the individual level rather than being shared across the whole company. While experience is gained through projects, if a project lasts 3-5 years, an individual may only be part of a few projects in their career.

Many of the interviewees said that although there is a lot of information within the company many don't have the time to look back and review it, but that it can happen when facing critical moments that they contact people who have done similar things to benefit from their expertise. Interviewee B2 said that "*the same mistakes are being repeated and that everyone often ends up trying to "reinvent the wheel*" instead of learning from each other". Interviewee B4 expressed that there are mistakes that persist from build to build and that people in general are quite bad at experience feedback and that there is room for improvement. While there is an internal feedback system, the interviewees felt that there is not enough time to review these.

Interviewee B1 expressed that they saw little value in following up or investigating the reasons behind issues, as every project is different and there is no industry standard. Instead of analysing the causes of deviations, they focus on taking action to resolve them. The researcher and professor who are knowledgeable about the topics said that looking at past experiences is only useful if they are comparable. Since there are no standardised practices that can be easily referenced, a significant

amount of time would need to be spent researching relevant experiences. As a result, many currently choose to prioritise problem-solving and project progress instead. To be able to use the data available from previous projects in the company, they need to be broken down into smaller pieces that are no longer unique and can be repeated. The challenge lies in retrieving and transforming this data into useful knowledge and by improving this process it could provide valuable support for those working in production. The researcher and professors' concrete suggestion was to break down planned activities into smaller parts so that they are no longer unique for each project but standardised and comparable instead. If activities were to be defined more uniformly, it would become easier to compare data across projects and analyse what actually works in practice. The researcher said that sorting the data in that type of way would open doors for further analysis in the follow-up process. These other factors could for example be construction methods, or specific work tasks based on follow-up data.

4.2.3 Challenges Regarding Follow-up in Production

Many of the interviewees shared that when it comes to follow-ups, the focus is more on how to move forward, and the actions to be taken now, rather than the reasons why and the root cause of the issue. This is because the completion time is the most important, critical and often the only thing that is a requirement from the client. Therefore, the focus always stays on how to be able to finish the project in time, as the final deadline is fixed and very hard to move. Many of the interviewees saw great potential when examining the current approach, believing that it could be more beneficial to focus on more things than the deadline. Interviewee C and D described their perception of the current state of the industry as one where projects' follow-up methods are focused on reactively changing what happens later rather than on the root causes of deviations. If one looks at it based on Lean construction thinking, the idea is to dig deeper into why things don't match according to the planning and solve the cause of the problem before it is repeated further down the line.

Interviewee D emphasised that there is a need for a structured approach when it comes to working with follow-up in production, stating that a manual or method is necessary. While not everything needs to be strictly defined, having clear, broad guidelines would provide a foundation to follow and support the supervisors and site managers. The interviewees who worked in the studied projects said that there was no proper standard or requirement for what follow-up method that should be used. It is up to the individual to choose how to work with the follow-up, the only requirement from the company is to do self-inspections.

Something that was brought up in several of the interviews, noted in both projects, was that the hours in the cost estimate were not always accurate which complicated the process of doing follow-ups. Interviewees A1, B2 and B5 highlighted that there is a problem with incorrect unit times throughout the industry, which gives the

wrong number of hours in the cost estimate. They are perceived as incorrect by the interviewees as they are not updated enough to match the complexity and variation of how the elements work in reality. The cost estimate is based on the basis of piecework, which means that the company cannot simply change this, even though they know that it is often wrong compared to reality.

In connection to this, Interviewee B4 emphasised that the hours become more accurate when they are based on knowledge and experience and not solely on the cost estimate and unit hours. They said that using a mixed approach allows for a more realistic reflection on the work hours and helps improve the accuracy of follow-up. Interviewee A1 said that this mismatch in hours leads to either too few or too many working hours on activities when creating the production plan. Not having the correct hours results in problems with staffing, both under- and overstaffing unless one has a lot of experience to be able to know that the cost estimate shows the wrong hours and therefore adjust after that. Interviewee A1 continues that one with less experience can easily end up in a situation with understaffing which can lead to activities being delayed creating multiple issues from the first initial issue with wrong hours. Interviewee B4 said that some of the experienced interviewees could handle this and adapt their approach and not rely fully on the cost estimate but for others, new in the role or less experienced this this is a bigger problem.

Interviewee A1 believes that the company has the wrong focus in the follow-up process. As of right now, the cost estimate in the project is very economy-focused and they think that it should be more activity-based since the projects are structured based on activities. This would make it easier to follow up more effectively, as it allows for a more specific view of which activities align with the schedule and budget, rather than a more general overview, which could result in missed opportunities to learn from the current project in future projects.

According to Interviewee A1, there are also not enough accounts in the cost estimate to be able to do proper follow-up. The current cost estimate groups several activities under one of five sub-accounts making it hard to follow-up on individual activities, as you cannot see the costs of them but instead only the total cost. They explained that this creates a misleading picture of the project's actual progress, making effective follow-up difficult. Without a clear view of which activities are working well and which ones need adjustment, it becomes challenging to take appropriate action. This is something Interviewee A1 had noted in many previous projects and therefore they together with the company decided to implement more sub-accounts in the cost estimate. Making Project A a pilot project with the goal of seeing if this can improve the production follow-up and then later be implemented in more projects.

4.3 Current Productivity Situation and Measurements in Production

This section of the chapter covers how the studied projects viewed productivity, their focus and attitudes towards working with it. It then includes the measurements and ways of working with it in the studied projects and lastly challenges and possibilities that were highlighted in the interviews.

4.3.1 Focus and Attitudes towards working with Productivity

A recurring theme in the interviews was the shared opinion that measuring and following up on productivity in production is a challenge. Several interviewees highlighted that productivity is often viewed in terms of meeting deadlines rather than optimising the use of time and resources. They shared that there is a tendency to focus on the end date rather than on analysing how effectively time is spent and on what during the project. While some supervisors track unit hours to compare planned versus actual progress, there is no standardised method for measuring productivity across projects. Some interviewees noted that productivity tracking efforts often rely on individual initiative rather than being an integrated part of project management.

When asked about how the interviewees work with productivity, the most common response was that they did not measure it at all or that they had their own Excel files documenting what they thought was important. Some interviewees were unsure and could not give an answer but those that did described that they simply went out on-site and estimated, guessing roughly a percentage of the work that had been completed. The measurement often consisted of recording how much of a specific activity had been completed, beyond this, there was no deeper analysis or follow-up on productivity.

4.3.2 Productivity Measurements in the Studied Projects

In Project B, Interviewee B5 said that they do work with it but it can be improved. They explained that they compare the unit hours once per month to track the progress in production. Additionally, Interviewee B4 said that in their block, they also worked on checking the hours used and comparing them to unit hours in order to reassign workers and optimise the work. In contrast to this, according to Interviewee B1, productivity was not something that they looked at and worked with.

One exception of looking at productivity on a deeper level was from Interviewee A1, who monitored productivity in production weekly in Project A. They compared the progress of what work has been done to what should have been done according to the

set productivity targets for each week. This was done by comparing the weekly plan with the cost estimate to evaluate if they were on track, too slow or ahead of schedule. An example of this approach was that they continuously checked and measured the installation of interior walls. Assessing how much they would be able to complete according to budget, time and planning, checking this every week. Interviewee A1 noted that if the hours had been more accurate from the cost estimate, or if there had been other comparable projects, they could have expanded this analysis and started looking at productivity in other areas beyond interior walls. Interviewee A3 shared that in the beginning, everyone started competing against each other, wanting to achieve the goal and perform, using the measurement as motivation to work even harder which resulted in increased productivity. However, along the way when someone was too slow, motivation started to drop. Eventually, it turned into a bragging situation among the workers resulting in more irritation than the initial motivation, which led to the opposite effect and no further increase in productivity occurred.

4.3.3 Challenges and Possibilities regarding Productivity in Production

Interviewee E said that they were unaware of how they currently worked with productivity or how they measured it in production in the current projects they support. They mentioned a lot of possibilities connected to productivity by working fully digitally in the planning process and advocated for implementing a digital approach. They said that you can look at different aspects, create custom filters and analyse efficiency and effectiveness, however, that is not something that is being done at the moment. The possibilities from working fully digitally were not shared by Interviewee F, who expressed concern for the people on-site explaining that it would be too advanced for them to work with. They said that effective use of digital planning tools requires extensive knowledge and a high level of familiarity with the program, something that many people do not have to the same extent as Interviewee E.

Another aspect of the challenge of measuring productivity that was highlighted by Interviewee C was the difficulty due to the many definitions. Their recommendation was to focus on not having deviations which is something that has a clear effect on productivity. They experienced that when productivity is discussed, much of the focus is on comparing time efficiency and identifying potential improvements but fixing deviations would affect productivity more. Interviewee D explained that the difficulty and complexity of measuring productivity is due to there being many factors that influence it. To ensure a meaningful and accurate analysis of productivity it is important to find a way to normalise high levels of detail data for productivity measurement. Interviewee D further explained that having an understanding of the different planning levels in production and knowing that they are interrelated is important and affects a project's productivity.

5

Discussion

The objectives of this study were to explore how planning and follow-up are conducted in practice and how they affect and can be used to enhance productivity. This was done by using a case study examining two ongoing projects from one company within the Swedish construction and civil engineering industry. This was examined through two research questions and investigated via interviews with site and block managers, supervisors, a researcher, a professor and specialists in the field. This chapter presents a discussion of the most significant findings in relation to the literature overview. By taking the theoretical framework and putting it in relation with the empirical findings the discussion highlights key similarities and discrepancies between theory and practice.

5.1 Planning in Production

This section of the chapter covers planning in production and discusses the differences regarding it that was found in the two studied projects, especially highlighting the importance of collaboration in the planning process.

5.1.1 Differences in Production Planning in the two Studied Projects

There were some major differences in how the two projects worked with planning in production and in comparison to what Hansson et al. (2021) described. According to Hansson et al. (2021) working in one common way throughout the planning process enhances it and was deemed an important factor in achieving the desired outcome from the plan. This was the case in Project A where the people on-site worked together with the planning process and with only one common way of working. The opposite occurred in Project B, where variations in methods and approaches used across different blocks influenced how the overall planning was structured. While some planned ahead, others relied on more flexible or ad-hoc approaches. These differences affected the overall consistency in production planning, leading to confusion and reducing control and awareness among those involved in the process. The outcomes of the planning processes in both projects support Hansson's et al. (2021)

statement that a unified approach enhances effectiveness in planning.

Another aspect that varied between projects was the extent to which individuals prioritised planning. Josephson and Saukkoriipi (2009) deemed planning as one of the most important activities in the construction process, which was something that differed between the interviewees in the study. This was also something that was evident, as the ones prioritising planning did not encounter the same problems and complications as those who did not value this as highly. This advocates the importance of recognising the value of planning.

5.1.2 The Importance of Collaboration in Planning

Kenley and Seppänen (2010) and Hansson et al.(2021) described rolling wave planning as a process where activities are broken down into detailed tasks, involving those who will actually carry out the work in the planning process. This is done to maintain control over what needs to be done in the near future, typically through continuous meetings. One finding from the results is that collaboration had a significant impact on the planning process in the projects, this was done differently in the two projects. One of the main differences was that in Project A, communication and coordination worked well between the site manager, supervisors and the trade groups performing the activities. In Project A, the use of rolling wave planning was similar to what is described by Kenley and Seppänen (2010) and Hansson et al. (2021). There were clear detailed descriptions of the tasks to be carried out for the upcoming two weeks which gave a clear picture of what was happening and who was responsible. This way of working was effective and made sure that everyone was aligned in the process and worked towards the same goal.

In Project B on the other hand, one main issue was the collaboration between the blocks. In some blocks, collaboration was prioritised, and a lot of effort was put into planning. Josephson and Saukkoriipi (2009) said that it is necessary for everyone to prioritise planning. In such a large and complex project as Project B is, it is therefore crucial to understand how the blocks are interrelated, and collaboration is needed to manage the production planning. These findings highlight a disconnection between how collaboration in the planning process should function according to Kenley and Seppänen (2010) and Hansson et al. (2021).

According to Dallasega et al. (2020) LPS enhances collaboration and information sharing, reduces rework and improves the overall reliability of schedules which was something that became clear in the comparison between the projects. Both projects used LPS but applied it in very different ways and to varying degrees which had different impacts. It was clear that in Project A they followed the concept of LPS. Productive work planning was prioritised and since the workers performing the activities were involved in updating the plan, there was no need for “firefighting”,

which is one of the benefits of using LPS according to Fuemana et al. (2013). This collaborative way of working, in addition to frequently having structured meetings each week, contributed to the overall reliability of their plans.

In contrast, Project B struggled to go from the overall plan down to monthly and weekly planning. Without having a common way of working, planning and collaboration between the blocks became harder and resulted in complications and delays. This has led to a lack of control in contrast to what was brought up as one positive effect of implementing LPS according to Kenley and Seppänen (2010).

This shows that simply requiring the use of LPS is not enough, there is also a need for clearer expectations and support to ensure it is used as intended. One thing that can be improved in Project B is that there should be more meetings and that these should occur more frequently, as it was done in Project A. This should be done to gain more control over activities that will be done between meetings. The meetings occurred at an interval of three weeks apart which means that it is not as effective as a lot can change within a week. Hansson et al. (2021) believe that the period in-betweens meetings should be around 10 to 14 days. Josephson and Saukkoriipi's (2009) study showed that only half of the planned activities in daily and weekly plans are completed, which highlights the need for continuous planning and follow-ups even more.

5.2 Follow-up in Production

This section of the chapter covers the topics regarding follow-up in production. Starting with the current follow-up methods used in the studied projects and highlighting potential improvements.

5.2.1 Use Follow-up as a Learning Opportunity

An important pillar of the LPS, according to Kenley and Seppenän (2010), is the learning process. The learning process consists of looking at Percent Plan Complete (PPC) which gives a value on the percentage of planned activities completed per week and Reason for Non-Completion (RNC) which consists of documenting and analysing the reason for being able to continue the work toward improvement. In both projects, there existed no effective system to document the reasons as to why deviations and mistakes occurred from the beginning. Since both projects did not work frequently with RNC they created a risk of repeating the same mistakes over again which was something that occurred in Project B. The reason for not looking into the root causes why deviations occurred was explained due to lack of time, according to several interviewees. This was a recurring reason why follow-up was not carried out to the desired extent as Kenley and Seppenän (2010) expressed the need of. Several of the interviewees expressed that other tasks were simply prioritised higher, such as

focusing on how to solve the problems and move forward. The interviewee's priority was to check the most critical moments when doing follow-up, which means that they can't work on improvements in the way that Kenley and Seppänen (2010) described with the help of RNC. Being a key component of LPS with the aim of learning from your mistakes and being able to work on improving your processes, this is an opportunity that the projects miss. The focus must shift from only prioritising the end time.

5.2.2 Potential Improvements to the Traditional Way of Doing Follow-ups

Both projects worked with traditional follow-ups done manually instead of digital and automated methods. The supervisors and the block managers walked around the sites and did estimates in percentage of how far they had come. Turkan et al. (2012) highlighted that the traditional approaches of doing follow-ups take more time than digital or automated follow-up methods. Furthermore, the follow-ups in the project were not always accurate as they were primarily based on estimates. This was something Musarat et al. (2024) highlighted and saw as a limitation of traditional follow-up methods.

Real time tracking, which was highlighted to be a very important factor in the follow-up process according to Duarte-Vidal et al. (2021), is deprioritised in practice and becomes something that they check if there is time for it. Implementing automated or digital follow-ups can solve the excuses for not having enough time available. With digital or automated follow-ups, the time needed compared to the current time spent on follow-ups would be less, while also providing more information than what is gathered today. In addition to that, implementing automated or digital follow-ups can increase accuracy. Duarte-Vidal et al. (2021) state that these digital or automated tools enable more accurate follow-up, compared to the current methods of doing estimates in percentages. If all projects do digital follow-ups it opens up opportunities to compare with other similar projects and see whether you are productive or not, get inspiration and find potential development opportunities from other projects.

5.3 The Impact of Planning and Follow-Up on Productivity in Production

This section explores how the planning and follow-up processes affect the way productivity is viewed and worked with in production in the studied projects. It highlights the relationship between these processes and productivity outcomes, as well as the methods and tools used for working with productivity in production.

5.3.1 Impact of Planning and Follow-up Processes on Productivity in the Studied Projects

As Bernolak (1997) states, working with productivity and productivity improvements becomes impossible without proper planning and follow-up processes. This highlights the importance of the way of working with the planning and follow-up processes when looking at a project's productivity. In Project A, their way of handling these processes had a positive impact, and they managed to maintain high productivity throughout the whole process of the project. In contrast, the way of working with planning and follow-up in Project B has affected the project's productivity in a negative way, due to inconsistency in planning and not collaborating enough between the blocks.

5.3.2 Methods and Tools for Productivity

One way of measuring productivity is with the use of PPC (Lean Construction Institute, n.d.). Even though the use of LPS was promoted on-site in the projects, the learning part that contains PPC was not utilised. By applying it in production, one can track how many of the planned activities are actually carried out, and provide insights into how effectively the planning is being followed. This percentage gives an indication of if they are doing the right things, according to the plan. To counteract the problem related to having the wrong focus when working with PPC, which was evident in the case study, Elkherbawy (2020) highlighted new methods, which the projects can implement instead. This adjusts PPC to take productivity into account and instead of seeing all activities as equals, this adjustment also takes prioritisation of activities into account. Acknowledging that activities require different amounts of work and are of different significance. By providing a nuanced view of PPC the progress and efficiency in production, one can gain deeper insight into the efficiency of the work being performed, beyond simply assessing whether it was completed as planned.

As the projects didn't work with PPC, they also didn't work with RNC and a major consequence of that is that it directly affects the project's productivity. When the same mistakes are repeated, rework is required, which means that time and financial resources have to be spent on correcting them. Some errors occurred frequently and were resolved on-site, but since they were not documented, followed up on, or addressed further, they continued to happen, ultimately impacting overall productivity. The lack of that type of data makes it hard to identify patterns and learn from previous experiences. This is a major improvement area for both of the projects and is something that could be implemented directly.

Since the main focus when doing follow-ups in the case study usually is on the final deadline there is rarely any deeper analysis looking at the actual hours spent in a project and what they are used for. As long as the project is overall in line with the schedule, the use of time during the process is not questioned, thereby missing opportunities for improvement that affect productivity since no valuable insights into inefficiencies or lost time are being missed. Josephson and Saukkoriipi (2009)

promote frequency studies which can be used to track how resources are being used. By doing that they state that waste can become visible. One would therefore be able to analyse whether hours are being allocated right to tasks and how efficient resources are being used. They also promote the use of value flow analysis which enables them to analyse if the work is being done effectively. By tracking the process of the carrying out of activities in production and noting how much time is being used to add value. This is followed by a closer analysis of what the other time is spent on and identifying wastes in the process that can be removed. These methods of working would contribute to work being more productive. A challenge highlighted in the interviews concerns the difficulty of following up on subcontractors' progress, especially when they are reluctant to confirm whether their tasks are fully completed. By implementing these proposed methods by Josephson and Saukkoriipi (2009) the difficulty of following up on subcontractors can be handled. Implementing such methods could contribute to increased productivity and offer a structured way to follow up on subcontractors' performance. In particular, they could help address the uncertainty around progress reporting, by providing objective data on task completion and workflow efficiency.

5.4 Company vs Project

This section explores how company-level factors influence project-level outcomes. It examines challenges related to cost estimation and their consequences for the studied projects. Furthermore, it highlights how company-wide requirements and guidelines shape work methods and affect production. The section also discusses difficulties in utilising experience and knowledge from previous projects in the company, as well as identified conflicts and misalignments that impact current planning and follow-up processes. Finally, reflections on potential improvements and future alignment between company practices and project execution are presented.

5.4.1 Issues Connected to the Cost Estimation

An issue found in the results, with a lot of following consequences, was that some interviewees perceived the hours in the cost estimate to be incorrect. This inaccuracy with "wrong hours", when the cost estimation and the outcome do not match, makes it difficult to evaluate if the work is going according to the plan or not, and if the work is done efficiently. This is something that needs to be addressed, as highlighted by Johnson (2020), as the cost estimation must align with methods used on-site for it to enable meaningful comparisons. By adjusting and improving the cost estimation in the future, it can enhance productivity in production by having the right resources and staffing available directly from the start, rather than realising it only after the activities have already begun.

The structure of having the activities grouped together in the cost estimation hinders effective follow-up, it prevents the identification and improvement of activities that are underperforming. Without a clear view of which activities are working well

and which ones need adjustment, it becomes challenging to take appropriate action. By enabling analysis of individual activities, potential improvements can be found, enhancing the productivity in production.

5.4.2 Requirements and Guidelines and Ways of Working

Many of the interviewees highlighted that working methods and routines are often shaped by personal experiences rather than shared guidelines, affecting outcomes and productivity. One major potential for improvement, as identified in this study, is the need for greater consistency in applying the same approach within a project. The interviewees described their respective ways of working and it became clear that there were significant differences between them. The company provides a high degree of freedom for the projects, essentially expecting teams to "just make it work", which can be problematic. This lack of structured guidance may explain the differences in the projects regarding approaches, and collaboration levels, sticking to one way of working while others do not. The high degree of freedom from the company evidently led to differences in the actual outcomes.

The findings regarding the differences in the projects connected to the planning and follow-up approaches suggest a need for clearer frameworks and stronger project guidelines to avoid these types of reactive situations. This is to ensure that everyone works in the same way, that it is done at a certain level and to avoid individual dependency. By having more clear requirements and guidelines on how these processes should be conducted, Project B would have not worked in their current way. The example of the supervisors trying to implement a digital way of working with LPS would have worked if that was a requirement at the beginning of the project and not something they wanted to implement in the middle of the project. As a result of there not existing an exact or clear way on how to work with rolling wave planning, these processes become highly dependent on the individual, their background, and experience.

To address these problems, the company needs to take more initiative in ensuring that the manager on-site takes a firmer stance on making sure that work is carried out in a consistent way at the workplace. As Kiiskinen and Mared (2021) argue, leadership is a crucial factor in creating a work culture within a project and Hansson et al. (2021) state that working in one common way is essential in production planning. These factors were highlighted as a main difference between the two projects. The result showed that the opinions in the projects were that one should be able to determine an approach in each project, but according to the company, that was already the case. Therefore, it can be concluded that the current problem in the approach in Project B is related to leadership since it is already up to the one in charge to decide.

5.4.3 Challenges Regarding the Usage of Previous Knowledge

The use of the knowledge that already exists in the company is one area in need of improvement. Many of the interviewees mentioned that there is a shared system designed for knowledge sharing but that it is rarely used, and when used, it is not as helpful as wanted. This was again explained by them due to a lack of time and an uncertainty of the relevance of what information can be used in one's own project. This raises questions about how well the information is adapted to the practical reality in production and whether the knowledge that actually exists in the organisation is really being utilised. There are documents in the company, but is the information recorded and described in a practical way enough to work in the workplace or is this just a case where it looks good in theory. This was something highlighted by Josephson and Saukkoriipi (2009), where it is pointed out that overly complex systems become counterproductive to their purpose.

A solution highlighted in the interviews with the researcher and professor regarding knowledge transfer and the current challenges in the industry, as well as in the two case studies, was the need to structure information in a more detailed and standardised way. Today this type of approach is limited, but there is a big potential with it. To be able to succeed a shared understanding within the company is required regarding how activities should be defined, documented and followed up on. It is not only about having the right digital systems for it to be able to function but also about establishing a common way of working and fostering a culture where reusing the experience is highly prioritised. The overall approach to knowledge sharing needs to be improved if companies are to benefit from past experiences and move towards a more productive way of working.

5.4.4 Different Misalignments Affecting Planning and Follow-up

Based on the findings from the interview it became evident that there appear to be a few differences regarding some topics on how to operate within the company and projects.

The first misalignment is regarding the support from the company time specialists. The difference appears to be between what the people out in production wish for compared to what the time specialists currently provide and how much support a project can receive from the time specialists. As brought up in the interviews, varying levels of knowledge concerning planning affect the way that the time specialists work with supporting projects. As the knowledge level varied, it became harder to create a standard for the time specialists, as the kind of support needed varied depending on the individual. This has led to the time specialists often taking over the planning and doing the work by themselves, instead of being there in a supporting and teaching role. As stated by AlNasseri and Aulin (2015) without the proper knowledge, planning

cannot succeed which can be seen in this case as it creates misalignments in the way of working.

Another misalignment, which is a bit contradictory, is how one is supposed to work with planning. The company advocates working with LPS and rolling wave planning in the individual preferable way, while the time specialist advocates only working with the digital method for rolling wave planning. This could be a reason why the support that is desired from the ones out in the projects differs from the support provided by the time specialists, as there are different opinions about working digitally or not. This results in different guidelines across projects, which clearly leads to the work being carried out in varying ways.

An additional identified misalignment is between what is a requirement and what is a choice. This concerns the perceived high level of freedom in the studied projects when it comes to the approach of working with planning and follow-up. If rolling wave planning is a component of Lean, the philosophy the company adheres to, then stating that the choice of method is optional becomes contradictory, as such flexibility does not align with Lean principles. The discussion that often arises when discussing finding "a standard approach" or "one way of planning and doing follow-ups" is that the reason why there is not one already exists is because the projects are "unique" and that it therefore is not possible to have just one standard. Each project is unique to some extent but there are many activities in a project that when broken into smaller parts can be comparable and standardised. To be able to work within Lean principles, there is a need to find common ways of working within projects and by those minimising variations. Lean is built on the principle that there is a standardised way of working to be able to find potential improvements. Without them it becomes hard to evaluate learnings and share them further between projects. With the current setup, the site and block managers are given a lot of responsibilities with a lot of expectations from the company on how to work with planning, which can be a problem as it then comes down to leadership. As brought up by Schein (2004), the structure and culture of a project are influenced by the project's leader. This raises a relevant question of whether rolling wave planning can truly contribute to continuous improvement when there is lacking a clear standard to build upon. Ultimately, it becomes a matter of how much flexibility can be allowed before rolling wave planning begins to contradict the Lean principles. A certain degree of standardisation is required to enable better project control, follow-up and long-term improvements.

5.5 Soft Aspects Affecting Planning and Follow-Up in Production

This section includes soft aspects that influence the culture in the projects and in the company. It also includes factors that affect leadership, support, training, and attitudes toward planning, follow-up and productivity, also covering what factors

and personal qualities that affect and decide on which type of planner one becomes. Furthermore, it covers the topics of planning culture and the perceived lack of it and how it affected the studied projects. It is followed by a discussion on how different levels of knowledge regarding planning and follow-up processes and productivity affected the studied projects. Lastly it discusses potential improvements that can be made to reach a common knowledge level in the company and in projects.

5.5.1 Ownership and Leadership related to Planning and Follow-up

Studying Project B raised questions about how such a project can operate as freely as it has and without a clearer structure and higher priority on planning from the beginning, especially considering the size, complexity and financial value. Is the priority on planning highly dependent on the individual leading a project? This leads to a broader reflection, are expectations, ways of working, and responsibilities not clearly defined from the start of projects? Is this level of variation common across different projects, companies, and even the industry as a whole? How these things are conducted has a big impact on productivity.

A difference between the two studied projects was the feeling of ownership and responsibility of activities, not only by trade workers but also by supervisors and managers on-site. One of the main benefits of rolling wave planning is according to Fuemana et al. (2013) and Dallasega et al. (2020) increased flexibility and better understanding among workers on-site regarding what is expected of them. Project A involved everyone in the planning process, which resulted in workers taking ownership of the activities they were supposed to perform. This made them feel a responsibility towards everyone else in production, which contributed to the timely completion of activities in accordance with the planning. This was not the case in Project B, where the project planner felt that people did not take responsibility for their planned activities.

The interviews highlighted the importance of having a stable plan, to make the trade groups feel secure in their work and what is expected of them by taking ownership of their activities. A positive outcome of this, where this approach took place, was that the overall culture and work environment improved as the trade workers started to enjoy the work.

As the projects each decided what type of working ways and approaches to work with, there was another factor which affected the project outcomes, and this was leadership. This aligns with what Schein (2004) described about leadership having a significant impact on a project. Where there was clear leadership, there was also a lot of experience working with planning as the managers highly prioritised it and valued it as one of the most important aspects of success within a project. They also knew how to proceed with it, which methods worked and how to get everyone to

work in the same way. For those leaders who lacked experience and/or clarity in their leadership, it became clear that routines and a structured way of working were lacking, which resulted in them planning more towards the "firefighting" approach. The company needs to take more initiative in ensuring that the manager on-site takes a firmer stance on making sure that work is carried out in a consistent way at the workplace. As Kiiskinen and Mared (2021) argue, leadership is a crucial factor in creating a work culture within a project and Hansson et al. (2021) state that working in one common way is essential in production planning. These factors were highlighted as a main difference between the two projects. The result showed that the opinions in the projects were that one should be able to determine an approach in each project, but according to the company, that was already the case. Therefore, it can be concluded that the current problem in the approach in Project B is related to leadership since it is already up to the one in charge to decide.

5.5.2 Importance of Having a Culture Prioritising Planning Culture

The culture in the projects and the company significantly impacts how effectively planning is carried out and prioritised. One of the key issues highlighted in this study is the lack of a structured approach when it comes to productivity measurement and working with productivity improvement in production. It is rarely measured, discussed, or used as a tool for learning in the studied projects. Productivity is something that cannot be viewed in isolation but that is a large consequence of the lack of planning and follow-up culture. When planning is inconsistent and follow-up is not prioritised or clearly structured, productivity becomes an abstract concept rather than a concrete focus for improvement. Efforts to improve productivity will not be effective unless the other processes are already well functioning. Without clear standards and guidelines, the responsibility falls on the individual and their level of knowledge and interest connected to it. It becomes hard for the individual to act when there is no support and clear help on how to work with it. The lack of requirements and guidelines on how to work with planning and follow-ups may reflect a deeper issue, that these topics might not be given sufficient priority within the company reflected by the situations in the studied projects. Schein (2004) described that the real culture exists in the projects, which makes it highly dependent on whether the person in charge prioritises it. When individuals have a strong focus and prioritise planning, it is mirrored in the planning approach, which are characterised by proactive thinking, clear communication, and structured workflows. In contrast, when that is missing, inefficiencies, last-minute problem-solving, and a lack of coordination are present. In order to create a well-functioning planning culture within projects, this issue needs to be recognised as a problem that must be addressed.

5.5.3 The Need of a Shared Base Level of Knowledge

The main difference observed between the studied projects was the varying levels of knowledge regarding planning and follow-up processes, which ultimately influenced productivity. One possible reason for this could be the absence of proper introduction or training explaining how the company expects the processes to be carried out, which tools and methods are available, and what these efforts are meant to achieve. This resulted in varying results in the projects and no predicted minimum level, neither regarding the knowledge level and the result. AlNasseri and Aulin (2015) argue that the value of the planning process will diminish without the proper knowledge level. This indicates that there might be a need to increase general knowledge on planning processes within the company. A possible way forward is therefore to establish a shared base level of knowledge within the organisation regarding these processes. This would help reduce deviations between projects and individuals, and ensure a more consistent use of rolling wave planning. By establishing a common baseline, it would become easier to distinguish between poor planning and genuine differences in working methods. This would also reduce the risk of inconsistent interpretations of what is expected in the planning process.

5.5.4 Potential Improvements to Achieve a Shared Base Level of Knowledge

To build up the minimal knowledge level and to create a culture both in the company and the projects where planning is automatically prioritised, they should create a natural learning process in the projects where a good supervisor over time later becomes a good site manager who trains new good supervisors. This approach will lead to a "snowball effect" where good supervisors become site managers who then train new supervisors. Several of our interviewees expressed a wish that this would work in practice, where skilled supervisors gradually grow into the role of site managers and in turn train the next generation of supervisors. However, this is currently not perceived to be functioning well, mainly due to a lack of time and the absence of structured learning.

The company should therefore invest time and resources on training to be able to create a shared minimum level of knowledge. While training programs and internal courses require financial resources, they are crucial for long-term improvements. To be able to achieve sustainable development it is suggested that the company should consider reducing short-term profit margins in favour of long-term skill development among employees. This needs to be done to reach the level that already are expected of their workers out on construction sites. This is also crucial if they want to succeed with having a culture where planning is prioritised and a shared perspective on planning is established.

6

Conclusion

This final chapter summarises the main findings of the study in relation to the research questions and presents the overall conclusions drawn from the results and discussion. It also outlines recommendations for future research and studies, based on the insights gained throughout the study.

6.1 Summary of the Study

This thesis aimed to examine how planning and follow-up processes were carried out in two different production projects within the same company and identify key challenges related to planning and follow-up. By identifying those, the study strived to contribute insights into why these challenges exist and possible areas for improvement. Lastly, the study aimed to identify how the chosen approach of planning and follow-up affected productivity in the project and identify what factors had an impact on those and potential ways to further enhance productivity in production. To achieve the aim of the thesis two research questions were formulated and an interview study was conducted.

RQ1 How are planning and follow-up conducted in production in building projects and what are the main challenges?

The results revealed that there was no standardised way of working with planning and follow-up in production in the studied projects and several different approaches appeared. The approach to planning and how they worked with daily, weekly and monthly planning were based on the Last Planner System (LPS), but the projects interpreted it in their own way. This resulted in varied ways of working with LPS between the two projects, but also between the different blocks. This highlighted the importance of prioritising the two processes, as there were a lot of differences in approaches depending on the individual level of prioritisation and knowledge. Regarding follow-up, the main focus was on addressing the problems that arose, finding a solution and then looking ahead, rather than not examining the root cause of the problem.

Throughout this thesis there were a lot of different challenges regarding the planning and follow-up processes that were highlighted. A significant challenge was collaboration between those involved in the planning process, and between blocks in big projects. Due to varying knowledge levels, the collaboration between the project's actors decreased. Another factor that influenced how planning and follow-up were carried out was the lack of clear structure and requirements on the project level. This led to leadership playing a major role in how these processes were managed. Projects in which leadership fails to establish a culture that advocates planning are likely to encounter difficulties during the production phase.

RQ2 How can the planning and follow-up processes be improved to potentially enhance productivity in production?

The study showed several ways that the planning and follow-up processes could be improved to potentially enhance productivity in production. Both studied projects used LPS to some extent but the learning stage that includes Percent Plan Complete (PPC) and Reason for Non-Completion (RNC) was not fully implemented. To enhance productivity these should be integrated systematically in the projects. Furthermore, PPC can be developed to take more aspects into account which can strengthen the continuous improvement process. In addition to PPC and RNC, there are other tools that can be implemented to better measure and work with productivity such as frequency studies and value flow analysis. The studied projects revealed that there is no systematic way to work with productivity in the projects currently. To enhance productivity in production, there is therefore a need for clear guidelines and requirements on a project level, to be able to create more standardised projects. This would align with the lean principles, where activities and processes are investigated. By doing this, the company can find the value-adding activities and minimise waste, thus increasing the productivity levels.

The results further revealed that the culture and prioritisation of planning and follow-up varied significantly between the studied projects. These differences were largely influenced by individual engagement, but also shaped by the company's overall approach to these processes. This highlights the importance of placing greater emphasis on planning and follow-up, along with fostering a clear understanding of their potential impact on productivity. Additionally, the findings indicate a need to build a common base level of knowledge within the organisation, which should then be reflected in the projects. One way to achieve this is through natural learning processes by enabling a snowball effect were good supervisors develop into good site managers, who in turn mentor and train the next generation of supervisors. The results thus emphasises the importance of both formal training and creating a company culture that supports continuous learning and knowledge transfer.

6.2 Limitations of the Study

The study had several limitations which could have affected the results. The first thing is that the case study is based on two projects within the same company. This means that the findings only represent a small portion of the company's active projects which limits the possibilities of drawing general conclusions. Another limitation is that the study has used qualitative methods for the data collection, making it highly dependable on the experiences of the participants. With this in mind, there is a risk that the interviewees have left out or downplayed or upscaled things which may have influenced the results. The number of interviewees used in the study has been considered sufficient, however, to widen the view and have an even more nuanced look at the findings more interviewees could have been held. Furthermore, the timeframe of the thesis has been a limitation which has affected both the number of projects and interviewees included in the study. With more time both numbers could have been higher resulting in drawing even more comparisons between projects and getting more perspectives. Lastly, since productivity is a wide term with many definitions, this study had to stick to one definition of it which could have affected how the interviewees chose to interpret it. As the interviewees can relate to this definition in different ways depending on the individual, this might be a factor that limited the findings.

6.3 Future Research and Studies

Based on the findings of this study, several ideas have emerged that could be explored further in future research within the field of construction planning, follow-up, and productivity. Below are some suggested directions for future research:

Continue to investigate how planning and follow-up are conducted in different projects and how these processes relate to productivity. Given the broad and often unclear definition of productivity in construction, further exploration could help clarify the link between planning practices and actual outcomes.

Identify potential areas for productivity improvements by focusing on specific activities or approaches or tools within the production process.

Conduct studies comparing what is expected and required from the projects versus the actual outcomes and what the reality is regarding planning and follow-up and its execution. This could reveal common deviations and their root causes.

Examine and compare large-scale projects with multiple supervisors and block managers, like Project B in this study, to understand how coordination and collaboration

between the blocks can be achieved and how it affects production productivity.

A comparison could also be done between companies with different organisational structure to explore the topic of culture and how it affects the outcomes of the projects. This includes looking at how much time, money, and effort is invested in training and education to ensure a baseline of knowledge across roles.

Explore the role of leadership and organisational structure, which emerged in this study as potentially important factors. It could be valuable to investigate how different leadership styles and structural setups affect the planning and follow-up approaches.

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A

Semi-structured Interview Questions for Site managers and Supervisors

Background
Briefly describe your role and educational background.
Describe your experience with planning and follow-up in production.

Planning
How do you work with planning in production at different levels? Daily, weekly, rolling planning (3–6 months)?
(Which tools or programs do you use, what are they used for, who has access, who is responsible for what?)
How do you handle problems or misalignments between planning levels?

Follow-up
How do you work with follow-up of the planning process? (At different levels?)
How do you work with lessons learned from previous experiences?
How do you handle deviations, and do you learn from them?
What are the main challenges in doing follow-up? Are there areas for improvement?

Productivity
How do you work with efficiency?
How do you try to increase efficiency through the planning and follow-up processes?
How do you measure it? (At different levels?)
How is the information documented? How accessible is it?

B

Semistructured Interview Questions for the Researcher and the Professor

Background
Briefly describe your role and educational background. Describe your experience with planning and follow-up in production.

Planning
How can planning in production be executed in different levels? Daily, weekly, rolling planning (3–6 months)? (Which tools or programs do you use, what are they used for, who has access, who is responsible for what?) How should problems or misalignments between planning levels be handled?

Follow-up
How should the follow-up of the planning process be executed? (At different levels?) How should lessons learned from previous experiences be incorporated? How should deviations be handled and how to learn from them? What are the main challenges in doing follow-up? Are there areas for improvement?

Productivity
How should efficiency be worked with in production? How can the planning and follow-up processes be used to increase efficiency in production? How can it be measured? (At different levels?) How can the information be documented? How accessible is it?

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