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A Structured Operational Workforce Planning Process

Proposal of a Standardized Process for TPL Warehousing

Master's thesis in Supply Chain Management

JOHANNA KARLSSON

ALEXANDRA TORSSON

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS
DIVISION OF SUPPLY AND OPERATIONS MANAGEMENT

CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2025
www.chalmers.se

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Department of Technology Management and Economics
Chalmers University of Technology
SE-412 96 Gothenburg
Sweden
Telephone +46 31 772 1000

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Abstract

Workforce planning is a central component in achieving operational efficiency and flexibility in TPL warehousing. Since labor is the main cost driver in warehouse operations, it is important that the right number of employees with the right skills are at the right place at the right time. Therefore, this study aims to develop a standardized operational workforce planning process by answering and identifying what workforce planning process steps should be included, which data is required, and how the process should be performed. This process is tailored specifically to the characteristics and challenges of TPL warehousing, with a focus on warehouse floor personnel.

The study was carried out using an abductive research approach and it is a multiple case study with four cases of varying size, customer base, and management structure. Data were collected through 12 semi-structured interviews and 5 site visits. The empirical findings were further analyzed together with the existing literature. When sufficient empirical findings and theoretical insights had been collected, research questions regarding the proposal of a standardized workforce planning process were answered.

In the final phase of the study, it was established which process steps, what data is required, and how the workforce planning process should be carried out. Subsequently, a proposal for a standardized workforce planning process for TPL warehousing was presented. The study used artificial intelligence to assist with sentence formulation.

Keywords: Third-Party Logistics, TPL, Warehousing, Operational Workforce Planning, Workforce Planning Process.

Acknowledgments

The master's thesis was conducted as part of the Supply Chain Management program at Chalmers University of Technology. The thesis was carried out during the spring of 2025. The report was initiated by the anonymized Company Alpha.

We would like to begin by sincerely thanking Company Alpha, with which we have had the opportunity to collaborate during this thesis project. Furthermore, we are thankful to our supervisor at the company for his dedication and support throughout the thesis. We also extend our thanks to his colleagues and other staff members for their valuable contributions, as well as for the insights gained during our study visits and interviews. In addition, we are thankful to all other participating case companies and the helpful professionals we had the opportunity to meet and interview throughout this project.

Finally, we express our deepest appreciation to our academic supervisor and examiner at Chalmers University of Technology, Robin Hanson, whose academic guidance and feedback have been greatly appreciated during the thesis.

Johanna Karlsson
Alexandra Torsson
Gothenburg, June 2025

List of Acronyms

Below is the list of acronyms that have been used throughout this thesis listed in alphabetical order:

B2B	Business to business
B2C	Business to customers
HR	Human Resources
KPI	Key Performance Indicator
LT	Lead Time
PDCA	Plan-Do-Check-Act
PMS	Production Monitoring System
SKU	Stock Keeping Unit
TPL	Third-Party Logistics
VAS	Value Adding Service
WMS	Warehouse Management System

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1
Introduction

The intention of this chapter is to introduce the reader to the scope of the master's thesis. It will begin with a background on the subject. Furthermore, the aim, research questions, and delimitations for the research will be set and explained in greater detail.

1.1 Background

Modern logistics require a high level of expertise, particularly within multifunctional organizations with multiple subsidiaries (Abrahamsson & Wandel, 1998). Meeting these expectations has resulted in more complex operations that need to work correctly, otherwise, they will have a negative impact on efficiency and cost-effective operations affecting the total logistics system. To evolve within this sector, companies are outsourcing their logistics operations to experts in the field, i.e. third-party logistics (TPL) providers.

The traditional organization of a logistical link with TPLs is usually divided in a way where the company still manages and controls the flow of the goods, whereas the outsourced part is only the execution itself (Abrahamsson & Wandel, 1998). For this type of contract to be profitable for the TPL provider, their solution is usually used by multiple companies, to gain economies of scale and scope. This type of availability further allows the TPL provider to offer lower costs and better service.

Research shows that warehousing is the most outsourced service (Minashkina & Happonen, 2023). At the same time, warehousing is seen as a crucial node in the total performance of the entire supply chain. Therefore, it is of high importance that a TPL provider can offer strong competitiveness in the market of outsourcing, due to the importance it holds within the supply chain.

For all companies that handle goods, regardless of whether it is a TPL provider or not, warehouse management plays a key role in the success of that company (Rushton et al., 2021). For warehouse management to be successful, essential investments must be made, and service levels must be maintained, while still keeping the costs down. The management of this type of facility may take on several SKU orders every day that need to be consolidated, packed and shipped. To accomplish these tasks, the operations can be divided into different levels depending on the timeline of the operation. The long and medium term decides on capacity planning in a way

that assures that the company can meet seasonal peaks, but also is able to grow. In the short term, a detailed plan is developed to determine the required amount of equipment and workforce that need to be available. Furthermore, the equipment and workforce need to be balanced between the warehouse zones in a way that generates the most efficiency.

Traditionally, the workforce is the most significant cost factor in a company's logistics and warehouse operations (Richards, 2022). This makes management and allocation of resources within this sector critical when striving for efficiency within the company. Workforce planning can in the simplest way be described as having the right people, with the right skills, in the right place, at the right time (Cillie-Schmidt, 2012). This means that workforce planning should effectively identify and anticipate the company needs, to align with organizational goals and strategic direction. Furthermore, it should be able to determine how much, at what time, and in what quantity, of the workforce is needed to meet the organizational goals.

The growing importance of workforce planning is driven by several factors. For example, the uncertain economic scenarios of consumer behavior require companies to be able to rearrange quickly and effectively (Cillie-Schmidt, 2012). To be able to have this type of flexibility within a company, workforce planning needs to be highly developed. Nevertheless, according to Cillie-Schmidt (2012), the introduction of e-commerce and transparent knowledge sharing within the organization requires companies to have a nonhierarchical, flexible, and interconnected organization design. This new organization design emphasizes collaboration, adaptability, and multidirectional communication, where workforce planning is crucial.

1.2 Aim

The study aims to develop a standardized operational workforce planning process tailored to TPL warehousing. The focus is specifically on warehouse floor personnel, excluding roles such as control tower personnel and other administrative roles. It will be achieved through a multiple case study that analyzes four different cases.

1.3 Research Questions

To fulfill the aim of the study, three different research questions were conducted, these have been summarized at the end of this chapter, see Table 1.1. An explanation of the research questions is found in the section below.

According to Bal (1998), a process can be divided into four different characteristics: functional, informational, behavioral, and organizational views. The functional view focuses on what needs to be done. With regard to this characteristic, the first research question *What process steps should a workforce planning process include?* was conducted. This question is relevant to determine which tasks should be carried

out within the process. The informational view represents what type of data specifics or elements that should be available in the process. This aspect is addressed by research question two *Which data is required to perform the workforce planning process?*. The behavioral view relates to the words how and when, whereas the organizational view refers to who is performing the process. In order to find a solution to how the process should be performed, an analysis was conducted to identify who would be responsible for it and when it should take place. This is addressed by research question number three *How should the workforce planning process be performed?*. This question aims to provide an understanding of how to perform the tasks that were found through research question one.

Table 1.1: *A summarization of the research questions.*

Number	Question
RQ1	What process steps should a workforce planning process include?
RQ2	Which data is required to perform the workforce planning process?
RQ3	How should the workforce planning process be performed?

1.4 Delimination

The thesis work will exclusively focus on the operational workforce planning process in TPL warehousing organizations. Further, the study only aims to present a standardized process, not include suggestions on how that process should be implemented for specific cases. Moreover, no suggestions will be made on how the case companies should fill the gaps that will form between the as-is process at the case companies compared to the proposed standardized process.

1.5 Outline of the Report

This outline will serve as a guide for the report and briefly present each chapter to clarify the structure of the report and how it supports the study's overall aim.

1 Introduction - This chapter introduces the background and context of the thesis together with the purpose and research questions. Moreover, delimitations are set and this outline is presented.

2 Methodology - The purpose of the methodology chapter is to outline the methodological structure used in the thesis. The chapter presents the research design, data collection methods, and analysis approach. It ends with a discussion on research quality.

3 Theoretical Framework - This chapter lays the theoretical foundation for the study by introducing key concepts. The concepts presented in this chapter will help explain the various factors that shape staffing decisions in warehouse operations.

4 Empirical Findings - The empirical findings are presented for the four cases included in the study. Each case begins with a description of the site, followed by the process steps of the operational workforce planning process, including involved roles, time frames, and used data.

5 Analysis and Results - This chapter presents a cross-case analysis based of the research questions, combining theoretical insights and empirical findings. Each section follows the steps of the planning process, aiming to present a standardized workforce planning model suited to TPL warehousing.

6 Discussion - The Discussion chapter reflects on the applicability of the proposed planning process in various TPL contexts, including workforce structure and seasonality. It also discusses continuous improvement, methodological and theoretical limitations, sustainability aspects, and suggests directions for future research.

7 Conclusion - The last chapter of the report includes the conclusion of the study.

2
Methodology

This chapter includes a detailed explanation of the methodology used in the thesis. The chapter consists of subchapters on Research Approach and Design, Data Collection, Data Analysis, Research Process, and Research Quality.

2.1 Research Approach and Design

The goal of an analyst is to develop theories that accurately reflect reality (Patel & Davidson, 2019). This is achieved by collecting and analyzing various forms of data and information during the research process, referred to as *empirical data*. To be able to combine the empirical data and theory, three different methods can be used: *Deductive-, Inductive-* and *Abductive* research approach.

The deductive research approach is constructed in a way where the researcher develops a hypothesis for unique cases from an already existing theory, which is later tested empirically (Bell et al., 2022). This is associated with the research tradition, more commonly named as *positivism*. The rationale for using this method in research is that it enhances objectivity by grounding the study in an already established theory (Patel & Davidson, 2019). Thus, while the subjective perception decreases, this type of method might influence the research direction and potentially overlook other relevant aspects. The deductive process might be viewed as linear, as it follows a straight work process. However, it is more disorganized than it might appear at first glance (Bell et al., 2022). New theoretical information can be published even before the researcher has conducted the findings and the data gathered might not even fit with the original hypothesis.

The inductive research approach can be explained as an alternative way of combining theory and research (Bell et al., 2022). A researcher who uses an inductive research approach may study the research object directly, without relying on existing theories. When patterns in the observation have been found, the researcher comes up with a new theory (Patel & Davidson, 2019). The risk with this approach is that the researcher does not know the scope and generalization of the new theory, as the empirical findings were set for a specific scenario, at a specific time and place. Once the theoretical reflection has been carried out, the researcher may choose to collect additional data to verify whether the theory holds or not (Bell et al., 2022). This approach is primarily referred to as *Iterative*, which means that the researcher moves back and forth between data and theory throughout the process.

The abductive research approach is a third method used to combine theory with literature. According to Patel and Davidson (2019), it can be viewed as a combination of the deductive and inductive approaches. The research process begins with an inductive approach to develop a clear and understandable explanation. Following this, a deductive approach is applied to test the explanation, leading to an adjustment of the theory.

The study aims to develop a standardized workforce planning process, a subject that lacks theories within the context. Therefore, an abductive research approach has been used. The work began with an initial literature review to gain a basic understanding of the topic. After that, data was collected from case companies to explore how workforce planning works in practice. As new findings appeared, it were continuously compared with theory, which helped to deepen understanding and adjust the theoretical perspective when needed. This approach made it possible to include relevant factors that emerged during the research, instead of being limited by a fixed hypothesis.

Regarding the overall design of the thesis, a multiple case study has been conducted. According to Yin (2009), multiple cases in a study are preferred over a single case, as such a study can be vulnerable to limited generalizability and may not reflect broader trends. Therefore, having at least two cases was considered preferable. The thesis was initiated by a Swedish TPL provider, further referred to as Company Alpha. Including Company Alpha, the thesis examined three case companies, where Company Alpha was divided into two cases because it has multiple sites. This enabled comparisons between four cases in total.

2.2 Data Collection

According to Kothari (2004), data collection can be divided into *quantitative* and *qualitative* data collection. Quantitative data collection is described as the gathering of numerical data that can be collected through, e.g., experiments and surveys (Creswell, 2009). Compared to quantitative data collection, qualitative data collection focuses on words instead of numbers (Bell et al., 2022). It is usually done through different types of interviews and is a method to assess opinions and behaviors (Kothari, 2004). For qualitative data, subjective interpretation is required to understand participants' experiences and viewpoints.

For the thesis, a qualitative approach to data collection has been used. The primary data were collected through interviews and case company visits. Secondary data were collected through a literature study. A more detailed explanation of these data collection methods is presented in the chapters below.

2.2.1 Interviews

According to Bell et al. (2022), interviews are the most commonly used method in research and can be divided into several different types of interviews. *Structured interviews* are when the interviews are structured to the point where all the respondents receive the exact same questions in the same order. This type of interview is often used when doing quantitative research.

Further, there are other types of interviews, more common in qualitative research, which are used to understand the respondent's perspective (Bell et al., 2022). *Semi-structured interviews* are explained as when the interviews contain questions that are more open and in a more general form, and when the sequence of the questions can vary. Non-planned follow-up questions could also occur. However, there is the possibility of including some closed questions for the purpose of background or analysis. Examples of such questions could be about the respondent's job title or how long they have worked for the company. The *unstructured interview* is explained by Bell et al. (2022) as only to be prepared with a list of topics or issues that will be addressed. There is no consideration given to the order or phrasing of the questions, which can make interviews with the same topic differ significantly from each other. In this study, a semi-structured interview style has been used. With semi-structured interviews, the interviews have been prepared with similar questions, without needing to be introduced in the exact same order. The respondents have also been asked follow-up questions during the interviews if something seemed important to investigate further and was within the scope of the study. The questions, that were used as a basis in the semi-structured interviews, can be found in Appendix A.

In qualitative research, Bell et al. (2022) presents *purposive sampling* to be the method best used when conducting interviews. Sampling refers to the segment of the population that is being researched. Purposive sampling means that the units (e.g., people, organizations, or departments) are not picked randomly, but rather with a purpose connected to the research questions. The samples must be chosen strategically and not by chance. In this study, sampling has been done several times: deciding which case companies to include in the study and deciding which individuals to interview at the case companies.

The sampling of individuals at the case companies has been done strategically, in line with purposive sampling. Several people in each case, who have insight into the issue and can provide relevant information regarding the research questions, have been interviewed. The site manager and all supervisors at Company Alpha Site I, Company Alpha Site II and Site III, and Company Beta were interviewed. At Company Gamma, only one Department Manager and Team Manager were interviewed in addition to the Production Manager. All interviewees in this study are listed in Table 2.1.

Table 2.1: *An overview of the subjects who were interviewed in this study.*

Company Alpha Site I		
Respondents	Date	Time (min)
Site Manager I	28th Feb.	60
Supervisor A	6th Mars	45
Supervisor B	7th & 12th Mars	100
Supervisor C	12th Mars	60
Company Alpha Site II & Site III		
Site Manager II & Warehouse Manager	17th Mars	60
Supervisor D	1st Apr.	30
Company Gamma		
Production Manager	9th Apr.	60
Department Manager (E-commerce) & Team Manager (E-commerce)	9th Apr.	50
Company Beta		
Site Manager B & HR Manager	11th Apr.	30
Supervisor E	11th Apr.	50
Supervisor F	11th Apr.	50

The first interviews were conducted at Company Alpha Site I, starting with Site Manager I, who provided general information about the workforce planning process. Following the initial interview, in-depth interviews were conducted about the workforce planning process with the supervisors. In these interviews, questions were asked about the workforce planning process, together with more specific questions about how each of them executes the process. Two interviews were held with Supervisor B, who made an in-depth walkthrough of the data used in the process.

After the interviews at Site I were conducted, a similar approach was taken with management at Site II and Site III. A combined interview with Site Manager II and the Warehouse Manager was conducted to get a more comprehensive view of the workforce planning process. Subsequently, an interview was conducted with Supervisor D at Site II.

Since this study was initiated by Company Alpha, data collection was carried out over an extended period. In contrast, data collection and interviews at Company Beta and Company Gamma were completed in a single day. However, the same criteria for the selection of the interviewees and the rationale behind the selection were applied to both Company Beta and Company Gamma. Due to the limited time frame, only one Department Manager and one Team Manager were interviewed at Company Gamma.

The sampling done in the study is aligned with purposive sampling and ensured that the interviews are generative toward the research questions.

2.2.2 Case Company Sampling and Visits

When sampling other warehouse companies for benchmarking, the research questions were kept in mind to ensure accuracy, in line with the purposive sampling method (Bell et al., 2022). Sampling within the Company Alpha organization, at Site II and Site III, was carried out to study a case with a different management structure, where both sites operate under the same management. In addition, the smaller size of these sites was considered a valuable contrast that could enable a comparison with Site I.

Furthermore, Company Beta was included in the sample to gain insight from an organization different from Company Alpha. Although smaller than Site I, Company Beta serves a larger customer base. Including this case was therefore expected to offer perspectives that might not be captured within the Alpha organization.

Moreover, Company Gamma was included as a fourth case in order to study a warehouse larger than Site I. Additionally, since Company Gamma cannot be fully categorized as a TPL warehouse, it was expected to provide further insight. However, it was important that their operations still resembled those of a TPL warehouse to ensure that the case remained relevant to the aim of the study. The sampling of Company Gamma provided an additional view on workforce planning.

The sample set of cases in the study represents a mix of both large and small warehouses, with differences in customer base, number of employees, and management structure. It allowed for not only a comparison of how the workforce planning process is carried out, but also an analysis of what influences the process and why it takes the form it does. This was important to answer the research questions and achieve the overall aim of the study.

In order to gain a deeper understanding of the workforce planning process for all case companies and sites, visits were made. These visits enabled the authors to gain basic knowledge of the companies and their operations in general, which acted as a guide for further analysis of the specific workforce planning processes.

2.2.3 Literature Review

Bell et al. (2022) addresses the importance of starting with a literature review at an early stage of research, to ensure that the research subject is of a new kind and thereby decrease the risk of replicating something that has already been accomplished. Accordingly, the initial literature review was conducted at the beginning of the study to gain more knowledge about the selected issue. The second stage of the literature review was accomplished after the primary data were gathered and analyzed to gain a more in-depth understanding of the results.

The literature was collected from books and articles from different electronic databases, including Google Scholar and Chalmers Library. Keywords used when searching for the literature include: *process, workforce management, workforce planning, third-*

party logistics management, warehouse management, staffing agencies, cross-trained workforce, rotation, competence matrix, PDCA and *forecasting*. In addition to the electronic sources, printed literature was found at Chalmers Library, accompanied by books that have been collected as student literature in relevant courses at Chalmers.

2.3 Data Analysis

Since the study was based on qualitative data, an appropriate data analysis method was crucial to ensure that the data were interpreted and assessed using the right tools. Braun and Clarke (2006) suggests thematic analysis when performing qualitative research. This method of data analysis is used to identify, analyze, and find patterns in the data and then interpret the meaning of these patterns. Thematic analysis is suggested by Braun and Clarke (2006) to be done in six steps:

1. Become familiar with the data:
   This step includes transcribing the interviews or reading through the material several times and taking notes for ideas.
2. Generating initial codes:
   In this step, interesting findings in the data will be noted, or coded.
3. Finding themes:
   The codes are collected and grouped by themes.
4. Reviewing themes:
   The themes are reviewed, both in relation to the codes, and the amount of data in each theme.
5. Defining and naming the themes:
   Each theme is further analyzed in order to ensure the meaning and focus of theme, and how it fits into the overall narrative of the analysis. Each theme gets named and defined.
6. Writing the analysis:
   The final step includes making illustrative examples, conducting deeper interpretation, and connecting the findings to the research questions and existing literature.

This data analysis method is described by Braun and Clarke (2006) to be a recursive process, which enables movement between the steps in the process. It is thus a fitting method used in combination with the abductive research approach done in the thesis work.

The thesis used the thematic data analysis method as described by Braun and Clarke (2006), to systematically analyze qualitative data collected from data collection. The analysis began with a comprehensive review of all interview transcripts to become familiar with the empirical material. During this process, initial ideas and patterns were noted.

Next, the data was coded based on the steps of the operational workforce planning process, such as Demand Assessment, Workforce Allocation, etc. These codes reflected concrete activities and decision points described by the interviewees and allowed the data to be organized according to the structure of the process. Coding in this way made it possible to compare how each process step was carried out across different companies and roles.

After the initial coding, broader patterns were identified across the dataset, leading to the development of themes. These themes captured more conceptual and interpretative aspects of the data, beyond the specific process steps. Examples of such themes include the need for flexibility, time frame, and data-driven decisions. While the codes described what was being done, the themes provided insight into how and why these steps were carried out in particular ways.

This structure for analysis was based on how things worked in practice, with codes tied to the actual process and themes showing broader patterns. It helped keep the thesis work focused on the actual empirical findings from the case, while also bringing out useful insights for answering the research questions and shaping a standard process.

2.4 Research Process

This chapter presents the research work process of the thesis, which was divided into four phases. The process is visualized in Figure 2.1. The first phase of the study was conducted through a literature review in order to gain an understanding of the subject. According to Patel and Davidson (2019), this is an exploratory approach and an important first step in cases where the researchers have little to no primary knowledge of the subject in question. While the extent of literature about the operational workforce planning process was limited, other subjects could be studied to gain an understanding of relevant concepts, frameworks, and influencing factors applicable to workforce planning in third-party logistics contexts.

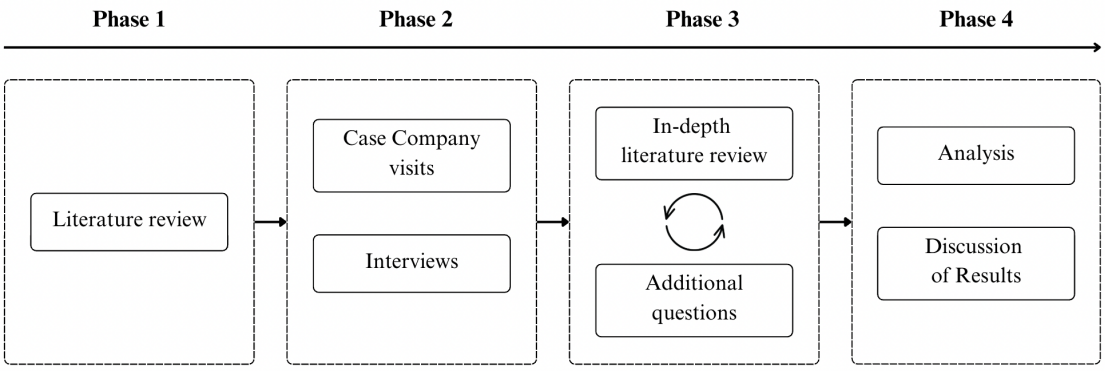

Figure 2.1: *Visualisation of the research process.*

The second phase of the process involved the main part of the primary data collection. This was carried out through site visits and interviews aimed at understanding the workforce planning processes. In line with the descriptive investigation approach proposed by Patel and Davidson (2019), the step was done to gain insight into the current state of these processes. The phase can be divided into two parts: the initial data collection was conducted at Company Alpha Site I, followed by additional data collection at Company Alpha Site II and III, Company Beta, and Company Gamma. Since the study was initiated by Company Alpha, particularly Site I, the initial focus was a natural starting point. For all cases, general information about the companies was gathered through site visits, while in-depth interviews were conducted to collect in-depth data on the workforce planning processes.

The third phase in the research process involved a more in-depth literature review. Since the research process of the thesis was done with an abductive, iterative approach, moving back and forth between theory and data collection was relevant. The purpose of the in-depth literature review was to gain further knowledge about the findings of the second phase and to enable additional analysis of the findings. This phase also allowed for any additional questions that arose about the data that were collected during phase two. In these cases, these questions were clarified through follow-up communication with relevant respondents.

Lastly, phase four includes the data analysis through thematic analysis, followed by a discussion of the results. The analysis was conducted iteratively in line with the abductive approach, allowing movement between theory and empirical data. The empirical findings for each case were compared with each other and analyzed in relation to the theoretical insights. Finally, a discussion of the results was conducted to analyze the applicability of the suggested workforce planning process.

2.5 Research Quality

Ensuring the quality of research requires careful consideration of both reliability and validity. This chapter will explore these fundamental concepts and how they were implemented in the research. Additionally, ethical considerations are discussed, to ensure responsible research practices.

2.5.1 Reliability

According to Hammond and Wellington (2021), reliability is determined by the consistency within the measurement. This means, for example, that if an interview were to be conducted with the same respondents with the same questions but at a different time, the answers would remain the same. Thus, receiving the same answers after multiple interviews might not ensure reliability as there might be constant external variables that the researcher has not acknowledged (Patel & Davidson, 2019). Variables such as influence from other respondents, time, and economy might affect the reliability of the respondents (Bell et al., 2022). To ensure that this was not done in this case study, a researcher can measure reliability through *inter-rater*

reliability (Patel & Davidson, 2019). This means that at the time of the interviews, two observers were present. Furthermore, to increase reliability, all interviews were audio recorded. This ensured that the information was preserved accurately and could be revisited to verify that the interpretations of the responses were correct.

2.5.2 Validity

Several threats may occur and affect the validity of research. Two different types of validity aspects will be acknowledged in this study, related to the research context, purpose, and goals. These are *Construct validity* and *External validity*.

Construct validity refers to how well the interviews will reflect on the research questions (Graziano & Raulin, 2014). This means that the interviews should be constructed in a way that gives the best available explanation of what the study is aiming for. Construct validity can be viewed as one of the most fundamental types of validity of this study. If the interviews are designed in a way that does not reflect the aim of the study, the findings are invalid regardless of other types of validity. To reduce the chance of construct validity threats, the definitions stated in this study are clear and the hypothesis is built on well-validated constructs (Graziano & Raulin, 2014).

External validity refers to how well the results given at a certain time and place are applicable in general terms at different conditions, times, and places (Graziano & Raulin, 2014). This means that the interviews, and results need to be in such a range that they can be remade and still give the same results. Thus, external validity is complex and difficult to promise because ethics guidelines require that participants provide informed consent. As a result, no sample can ever be entirely random unless all selected individuals agree to participate. Thereby, to enhance the external validity of the study, purposive sampling of the companies studied was essential, to decrease the risk of bias. Moreover, by including other case companies within the study, instead of only one, a more general view of workforce planning at TPL warehouses could be conducted.

2.5.3 Ethical Consideration

This study has a responsibility not only to ensure that research was conducted ethically but also to focus on important questions and at the same time maintain high quality. The goal of research, in general, is to bring trustworthy knowledge both for the people and the development of society (Patel & Davidson, 2019). Thus, the public benefits that research will bring must also consider the protection of individuals from unnecessary violation of personal information. Furthermore, individuals must not be subjected to psychological or physical harm, humiliation, or violation.

The Swedish Research Council (Vetenskapsrådet) has conducted four ethical principles that a researcher must follow: The information-, consent-, confidentiality, and use requirement (Patel & Davidson, 2019). To align with these ethical principles,

this study provided all respondents with information about the study and what knowledge their participation would bring to the research. All respondents had an opportunity to withdraw their participation at any moment within the time frame of the study. In addition, all participants, including both companies and individual respondents, were anonymized to protect personal privacy and uphold business confidentiality. All interviews within the study were recorded and transcribed with consent by the participant. Furthermore, all participants had an opportunity to review the report before publication and thereby also had the possibility to give feedback and consent to the content. If a participant believed that there was any misinterpretation, that section had been rewritten before publication. All data that was collected about individuals within this report had only been used for the purpose of the research.

3
Theoretical Framework

This chapter lays the theoretical foundation for the study by introducing key concepts related to warehousing and workforce planning, with a focus on the operational level. Throughout the chapter, the aim is to build a clearer understanding of the different factors that influence staffing decisions in warehouse environments.

3.1 Warehousing

According to Indian Institute of Materials Management (2020), warehousing is an important part of the supply chain as it enables the storage and holding of goods. Rushton et al. (2021) also amplifies the importance of warehouses due to the many parts of the supply chain where a warehouse is used. Different types of warehouses are part of different parts of the supply chain. A supply chain that involves sourcing, production, and distribution can include several types of warehouses such as raw material, work-in-progress, and finished goods warehouses.

Indian Institute of Materials Management (2020) presents five general process steps for the warehouse operations: *Receiving, Putting Away, Storing, Order Picking*, and *Packing and Shipping*. The storing step can be seen as the fundamental objective of a warehouse, and no physical activities are performed in this step. If storing is seen as the middle point, the other activities can be divided into two groups, *Inbound* and *Outbound* functions leading to and from the storing of goods (Bartholdi III & Hackman, 2019). Receiving and putting away are included in the Inbound function, while Order Picking and Packing and Shipping are included in the Outbound functions. These general steps enable the main service that a warehouse should perform, which is to efficiently manage the flow of goods by receiving large quantities of products, breaking them down into smaller units and redistributing them to users (Bartholdi III & Hackman, 2019; Minashkina & Happonen, 2023).

The steps in the previous section can be seen as the main flow of goods in a warehouse, whereas there is also the return flow of goods (Bartholdi III & Hackman, 2019). The handling of returns goods is important in warehouse operations, especially in operations supporting e-commerce. In addition to this, many warehouses also include other value-adding activities. In TPL warehousing, this is called *Value Adding Services* (VAS). These services include activities such as *Assembly, Kitting, Repacking* and *Labeling*. These services enables the TPL company to stay flexible, forming unique logistical solutions for each customer.

Within a supply chain, Rushton et al. (2021) explains warehousing to be one of the most costly elements. This is due to the large physical space warehouses require, the size of the workforce needed to operate the warehouses and the advanced automated equipment often used in the warehouse. Therefore, the management is critical to ensure high service and low costs. According to Minashkina and Happonen (2023), warehouse management should include knowledge of the warehouse organization, processes and resources.

During the last two decades, e-commerce has increased drastically (Gawor & Hoberg, 2019). Research suggests that this rapid expansion is largely due to the increased use of the internet and the convenience offered by online shopping. Consumers can easily make purchases using devices such as smartphones and benefit from access to product descriptions and customer reviews. In addition, utilitarian factors such as the ability to compare prices, access a wider range of products, and shop at any time of the day have further contributed to the rise of e-commerce.

The lead time (LT) is defined by the time taken from the time customers place an order until the customer receives the item (Gawor & Hoberg, 2019). Since consumers seem to be short of time and associate online shopping with convenience, LT plays a critical role in B2C fulfillment. In this context, convenience largely reflects the desire for short LT, allowing customers to access and use products as quickly as possible. In an omni-channel context, shorter LT often result in higher operational costs. However, longer LT can reduce customer loyalty, creating a trade-off between cost efficiency and maintaining sales.

3.1.1 Workforce Management

The dynamic organizational environment, for example, in customer needs, technology, and social shifts, has led companies to recognize the importance of proactive and flexible workforce management (Cillie-Schmidt, 2012). A crucial step in preparing the company for this approach is establishing a robust strategic planning process. Similarly to this process, the organization's effort to hire the right people, assuring that the right workforce is available to execute the strategy. This has resulted in the fact that workforce planning has become the most important function within Human Resources (HR). Workforce management must be able to create a balance of just enough personnel. This means that if there are too many, labor costs will be unnecessary high, low productivity, and decreased profits. Thus, too few will create quality problems, employee burnout, and low attainment (Smith, 1998).

Workforce planning aims to align with organizational goals and strategic direction by identifying and forecasting the company's workforce requirements (Cillie-Schmidt, 2012). This may be conducted by estimating the number, timing, and quality of the personnel. There are mainly three areas within workforce planning, which is divided by the length of the planning horizon (NSW Public Service Commission, 2019).

- Strategic workforce planning - Long-term decisions
- Tactical workforce planning - Mid-term decisions
- Operational workforce planning - short-term decisions

The different stages of workforce planning are not strictly sequential, but are, instead, connected parts that inform and influence each other (NSW Public Service Commission, 2019). Most companies address tactical workforce planning when deciding the annual budget and the number of personnel (Cillie-Schmidt, 2012). However, strategic workforce planning is not widely used, despite its ability to effectively manage staffing needs and proactively identify potential workforce shortages.

Workforce planning provides many advantages, and independently of what type of company it is to be conducted in, it should be implemented differently depending on the specific benefits the company finds relevant (Cillie-Schmidt, 2012). Workforce planning gives an opportunity to respond more quickly and strategically to disturbances by enabling managers to recognize and respond to evolving challenges in the market, workforce, and business. In addition, it improves efficiency, effectiveness, and productivity, by ensuring that personnel have the right training and are well suited for the role. Workforce planning also helps with planning and strategic staffing by identifying future workforce needs in a timely manner and making sure that gaps in the workforce are filled with replacements. The following section provides a more in-depth description of the three stages of workforce planning. While the main focus of the report is on operational workforce planning, strategic and tactical planning will also be addressed to offer a more comprehensive understanding.

3.1.1.1 Strategic Workforce Planning

Strategic workforce planning analyzes workforce trends such as employee turnover, career progression, and employee loyalty (Wiesflecker et al., 2024). It helps align hiring strategies to meet anticipated staffing needs for future periods. Strategic workforce planning is not something new, however, the complexity that some organizations require today is different from that before (Sparkman, 2018). The simplest way to define an organization's strategic workforce planning is by examining the concept of planning in relation to personnel. For example, if a company finds that its personnel are close to retirement, strategic workforce planning helps plan for this transition. Thus, a developed strategic workforce planning will not only address the strategic questions that will arise during the hiring period. It should also create a comprehensive project plan with well-structured information on working roles, timelines, and outcomes for success. In simple terms, strategic workforce planning is the process that takes the responsibility to see the opportunities and challenges related to the workforce that can arise within the organization when the business changes. It involves creating a strategy that will take advantage of the opportunities that are found while at the same time minimizing the risks associated with the potential transitions.

3.1.1.2 Tactical Workforce Planning

Tactical workforce planning focuses on specific action plans that help to achieve the goals that are set in the organization's strategic workforce plan (NSW Public Service Commission, 2019). The time frame within this stage is approximately one year and aims to complete the required work related to the given time and budget. All departments within an organization should develop their own tactical plan, typically involving Chief Financial Officers, HR Directors, and senior leaders. Areas that tactical planning is a part of is for example: marketing strategies, succession planning, workflow arrangements, and policies for particular work areas. This means that tactical planning describes how tasks should be carried out in a specific area to efficiently meet the goals set in the strategic workforce plan.

3.1.1.3 Operational Workforce Planning

Operational workforce planning focuses on enabling an organization to achieve its short-term objectives by ensuring that the right people and resources are in the right place in daily operations (NSW Public Service Commission, 2019). This stage involves closely monitoring current workloads, forecasting near-term operational or resource needs, and making sure that unexpected changes are promptly addressed. HR professionals and individual team managers typically lead operational workforce planning. Responsibilities for the one driving this step include creating and updating crucial procedures, processes, and rosters. This is done to make sure that all employees know their roles and responsibilities. In this step, recruitment coordination is also performed, which is the task of identifying staffing gaps and initiating hiring processes for e.g. seasonal peaks. In general, operational workforce planning ensures that daily tasks are completed effectively.

3.2 Forecast

According to Sanders (2015), forecasting is used to predict the future. In business, it is usually used to predict customer sales or product demand. Therefore, bad forecasts result in poor business decisions, as the company will be unprepared for future demands. Moreover, forecasts enable planning for the future.

While it is difficult to perfectly predict the future through forecasting, short-term forecasts tend to be more accurate than those covering longer time horizons (Sanders, 2015). This is largely because the short-term forecasts are based on more recent and accurate data. There are several different types of forecasting methods, and it is important to select the one most suitable for the purpose it is intended for. Further, explained by Chambers et al. (1971), each method of forecasting has its special use, and the right method for every situation is different. When choosing a forecasting method, several aspects should be taken into account, such as how much historical data is available and relevant, how precise the forecast needs to be, the time span it should cover, and how much the forecast will benefit the organization.

Sanders (2015) explains that any type of prediction or estimation is in fact forecasting. However, there is a distinction between forecasts based on quantitative models using historical data and those based on qualitative judgment or expert opinion, where the former relies on mathematical techniques and the latter on human insight and experience. According to Chambers et al. (1971), experience and knowledge become especially important when there is a shortage of historical data.

According to Mashiloane and Chinomona (2018), sharing information between partners within the supply chain will improve operations, performance and profitability. Forecasts are especially important to share (Forslund & Jonsson, 2007). In addition, forecasts must be accurate and shared at the right time, to enable qualitative decision-making and planning (Valashiya & Luke, 2023). Without accurate forecasts, resource planning will most often result in either a surplus or a shortage of allocated resources, leading to unnecessary costs (Sanders, 2015).

Bon and Shi Jun (2016) emphasizes that demand forecasting forms the foundation of resource planning, which includes workforce planning. They also highlight its significance for effective resource allocation. This perspective is further developed by Slack (2013), who elaborates on the concept of demand and the importance of accurate demand estimation in determining the capacity required to meet it.

3.3 Estimating Necessary Staffing Levels

Effective workforce planning requires a skill that can manage both human resource management and process management (Smith, 1998). To be able to understand the personnel requirements that are needed, a manager must first understand the processes to be performed. Process management includes duties such as identifying and controlling the different work processes in a designated area. According to Smith (1998), to manage HR management, the following duties must be in place:

1. Identify and determine the fundamental warehouse activities to be carried out.
2. Record and estimate the time required for nonproductive tasks.
3. Set a standard or benchmark for the expected time needed to complete each activity
4. Estimate future workload and formulate a personnel plan.

The first step in developing a workforce planning is to determine which activities in a warehouse that are frequently performed (Smith, 1998). The activities that are frequently performed are the ones that are required to have a standard value assigned, for example, the number of units that could be done in an hour. For activities that are performed infrequently, the required time can be calculated as hours per day or week needed to complete the task. Examples of activities that are usually performed in a warehouse are described in Section 3.1.

In the second step, nonproductive activities must be defined. It is unrealistic to assume that an employee working an eight-hour shift will be fully productive for the entire duration (Smith, 1998). Breaks, such as coffee breaks, are normal and necessary, which means that employees may not work every minute of their scheduled hours. If this is not considered, there may not be enough staff to handle the workload.

Step three requires the organization to get a standard or benchmark for each activity (Smith, 1998). This standard can be e.g. picked order lines per hour in a picking process, or pallets per hour in an putting-away process, and is equivalent with productivity. It can be both time-consuming and costly to acquire standards for each process and activity. However, research shows that the control and cost savings gained from such work are well worth the investment.

Thereafter, the number of personnel required for the estimated demand can be calculated using generalized formulas Smith (1998). Information on estimating demand is found in Section 3.2. The Daily Workload in Formula 3.1 is calculated using the forecasted demand and the Benchmark Productivity standard. Thereafter, the Required number of personnel can be calculated using Formula 3.2 using the Daily Workload and the time that one employee works each day. Important is to not inlcude the time spent on nonproductive activities in this calculation, to get an accurate result.

$$\text{Daily Workload} = \frac{\text{Estimated Demand}}{\text{Benchmark Productivity}} \tag{3.1}$$

$$\text{Required number of personnel} = \frac{\text{Daily Workload}}{\text{Time/Daily/Employee}} \tag{3.2}$$

3.4 Workforce Structure, Training, and Competence Management in Warehousing

According to Higginbothem (2025), employees are the most important asset in warehouse operations. For staff members to work as efficiently as possible, their tasks must be properly organized (Krynke et al., 2019). This involves structuring human resources in a way that minimizes unnecessary effort, limits time waste, and maximizes overall results. If a company does not organize this properly, it risks creating avoidable costs, less favorable working conditions, and unnecessary time consumption.

Allocating staff members to different workstations is a complex task, but an important part of optimizing operations (Krynke et al., 2019). In simple terms, workforce allocation refers to assigning employees to different tasks in a way that keeps related costs low while still achieving a high level of overall efficiency. To be effective, the allocation process should consider factors such as employee performance, skill level, and relevant experience.

With this in mind, the following subchapter will introduce different types of staffing, focusing on both internal and external staff. While the report does not specifically aim to determine which staffing strategy should be used, the theoretical background enhances the understanding of these strategies, which in turn is important as the staffing strategy correlates to how the workforce planning is conducted. Further, the chapter will introduce various approaches to training aimed at improving workforce efficiency. Moreover, this chapter will also discuss tools that can be used in the workforce planning process to provide a documented overview of employees' competences.

3.4.1 The Role of Staffing Agencies in Warehousing

The difference between internal and external employees is that the external employees have their employment with the staffing agency, while internal personnel have employment directly with the company (Håkansson & Isidorsson, 2016). Therefore, the company has a responsibility towards its internal staff, while the staffing agency is responsible for the external personnel. This setup allows companies to adjust their workforce based on daily capacity needs. A greater need for flexibility allows for a higher proportion of external personnel. If the required capacity is low during a certain period, it is the staffing agency's responsibility to find alternative work for the external personnel that the company no longer requires.

Ackerman (1997) recognizes warehousing to be a business where capacity requirements fluctuate. Richards (2022) identifies the workforce as the leading cost factor in the warehouse operations. Staffing agencies are used by companies to enhance the flexibility in their workforce capacity (Håkansson & Isidorsson, 2016). This is the reason why the use of staffing agencies is a widespread practice in the logistics- and warehouse industry in Sweden (Kompetensföretagen, 2024).

In addition to staying flexible, companies can use staffing agencies to keep stability in cases of absent staff, such as sick leave (Håkansson & Isidorsson, 2016). Then, external personnel can be used to substitute. Another, more strategic, use of staffing agencies is to hire external personnel on a continuous basis. This is done to keep the external personnel as a sort of buffer until the staffing demand eventually drops.

Another motive to use staffing agencies is, according to Coe et al. (2010), to evade the costs of the recruitment and hiring processes. However, the cost of the external personnel can be considered higher than for internal personnel, as the staffing agency adds a margin to the salary. In addition to this, arranged by the Swedish Unions,

external personnel receive the average wage based on the overall wage level at the company, which is a higher salary than if they were to be hired with an entry-level salary (Håkansson & Isidorsson, 2016). This also supports the arguments that using staffing agencies can generate higher costs.

According to Rouvroye et al. (2023), companies with a large share of external workers may struggle to develop knowledge for these workers. Since turnover among external staff is typically higher than among internal staff, companies often hesitate to invest in their training as it may be unprofitable. This, in turn, can impact keeping the external workers, as they might feel underappreciated due to the lack of development opportunities. Further, external workers who are not hired full-time might search for other opportunities, resulting in a loss of experience in the workforce, regardless if the worker has more or less training within the company.

3.4.2 Part-Time Employees

Another way to keep flexibility and meet the fluctuating demand is to use part-time employees (Houseman, 2000). Part-time workers are employees of the organization, that work less then a full work week. These employees are often used by companies during peak time hours of the day or week, or for shorter shifts. Furthermore, they are utilized by companies during peak season, when demand is higher than usual. While flexibility is greater than with full-time employees, Swedish law requires employers to notify part-time employees, the same as for full-time employees, of their schedules at least two weeks in advance (SFS 1982:673).

Part-time workers are often employed on a part-time basis because they prefer it, as it suits their personal needs (Houseman, 2000). However, according to Statistiska Centralbyrån (2025), one of the most common reason for part-time employment in Sweden is that the worker have not been able to find full-time employment, or because their employer does not offer any full-time positions. Other reasons include pursuing studies, caring for children, or dealing with illness or reduced work capacity.

3.4.3 Hourly Workers

Another employment type is hourly workers, also called on-call workers. These employees are, similar to part-time workers, internally employed at the organization or company. This form of employment allows the company to schedule the employees at shorter notice, often in situations where demand spikes rapidly or in situations of sick leave Houseman (2000). Other occasions where hourly workers are utilized by companies are during peak time hours of the day or week, or for specific projects. This allows for even higher flexibility, which can be useful in warehousing. Moreover, the cost of having hourly workers is lower than having full-time workers, as they will never be underutilized.

Hourly work means that the individual is paid based on the number of hours worked (Kommunal, 2025). As a result, employers can schedule these workers on short

notice, while the workers retain the right to decline the offer, since they are not formally employed outside the hours they actually work. Overall, hourly workers represent a flexible and cost-effective workforce that can help companies handle fluctuations in demand. At the same time, this form of employment can benefit individuals who prefer or require flexible working hours.

3.4.4 Training

Nda and Yazdani Fard (2013) emphasize that organizations that prioritize effective training and development for their employees are better positioned to gain short- and long-term sustainable benefits in a dynamic and competitive market environment. Research shows that employee training plays an important role in not only improving the technical skills needed for completing tasks at a workplace, but also increasing motivation and engagement among staff members. When employees feel confident in their abilities and supported in their development, they are more likely to be productive and aligned with the overall goals of the organization. In addition, investing in employee training has been shown to reduce staff turnover and absenteeism. This is because training opportunities lead to higher job satisfaction and a stronger sense of commitment to the workplace.

3.4.4.1 Cross-Trained Workforce

Real-time allocation, is defined as the situation that occurs when demand and supply are not aligned, requiring immediate adjustments to allocate personnel as needs occur in real-time (Shandong & Robb, 2019). This issue frequently arises due to poorly developed forecasting and scheduling systems. The reason for not having a structured real-time allocation plan in place for when these situations arise is due to the complexity of the problem. Decisions in these situations often need to be made quickly, as delays can cause the situation to escalate or become more difficult to manage. However, a common, and yet flexible, strategy to address this problem is to have multiskilled workforce.

Cross-training is defined as training a staff member to know how to do additional tasks within the organization (Vasanthi & Basariya, 2018). In a warehouse context, this involves preparing staff to handle multiple roles on the shop floor, rather than restricting them to one specific task. Cross-training can be divided into three dimensions: extent, breadth, and depth (Shandong & Robb, 2019). The first dimension, extent, refers to how much an employee is cross-trained within their own department. Breadth describes how many other departments the employee has been trained to work in. Finally, depth relates to how effective or efficient the employee is when performing tasks outside their primary department.

Effective cross-training increases organizational flexibility, particularly during periods of illness or absenteeism, by ensuring that staff can substitute for one another when necessary (Vasanthi & Basariya, 2018). Moreover, cross-trained employees can contribute across different departments, which enhances productivity during peak periods when workload distribution is uneven. Research shows that cross-training

reduces job monotony and associated boredom by introducing variation. In addition, the research states that employees who receive regular training are more likely to be positive towards changes within the organization and suggest improvements because they have a greater understanding of overall operations.

From the company's perspective, cross-training will offer cost savings as the need for new employees will decrease if existing personnel can be used as substitutes, while simultaneously increasing the value of each employee by expanding their skills and responsibilities (Vasanthi & Basariya, 2018). However, a potential disadvantage of cross-training staff is that it may negatively impact employee morale. Employees may feel threatened if other staff members can perform their specialized tasks, which can lead to a decrease in confidence.

3.4.4.2 Rotation

Job rotation can be defined as moving an employee between different tasks or departments for a set period of time in a certain sequence (Hochdörffer et al., 2018). A workplace that implements daily job rotation and offers a variety of assignments will develop a workforce capable of handling multiple tasks and a wide range of products. However, if personnel are not rotated regularly, their skills may become outdated and they may forget how to perform certain tasks. Therefore, employees must train and rotate frequently across different assignments. This creates a trade-off between longer and shorter rotation intervals, while frequent rotation keeps skills fresh, staying longer in a particular role allows staff members to develop deeper expertise. According to Hochdörffer et al. (2018), the process of mapping the available workforce together with the different tasks within a department is referred to as allocation. This typically highlights the qualifications of each staff member in relation to workplace requirements.

3.4.5 Competence and Competence Matrix

Competences in an organization are viewed by Milewska and Gembalska-Kwiecień (2020) to be a valuable capital for disposal. In this study, competences are defined in line with the article by Milewska and Gembalska-Kwiecień (2020), which is a combination of elements held by an employee. These are *Knowledge, Skills* and *Attitude*. Knowledge can be described as the theoretical understanding and qualifications required in order to carry out a task. Skills are described as the practical ability of the employee. At last, attitude refers to the motivation and mindset for the employees' responsibilities.

Keeping track of competences within the workforce is important as it enables the identification of competence gaps which can be used in recruitment, planning training needs and transfers within the company (Milewska & Gembalska-Kwiecień, 2020). Monitoring competences can be done in different ways, however, using a competence matrix is a tool that provides good visualization and enable easy comparisons.

According to Milewska and Gembalska-Kwiecień (2020), the competence matrix are structured as a table, where employees, roles, or positions are on one axis and competences on the other. Furthermore, it should only involve those who are significant from the perspective of the functions, thus not having the same matrix for shop floor workers as for administrative roles. To visualize if an employee has a certain competence, indicators are often used on a scale instead of a simple yes or no answer. These indicators can be numbers, colors or figures, and often follow a scale from "Lack of competence" to "Expert".

Milewska and Gembalska-Kwiecień (2020) presents the competence matrix as a tool to ensure effective allocation of personnel, and underscores that it is especially important in larger organizations. Moreover, the use of the competence matrix enables effective replacement of employees, as it shows who has the same competences as the one who needs to be replaced.

3.5 The Importance of Knowledge Sharing and Coordination

According to Machado and Davim (2019), knowledge represents the most valuable asset within an organization. Consequently, organizations led by knowledgeable management can gain a competitive edge. Sharing knowledge among employees and between teams enables organizations to leverage and expand their knowledge resources (Wang & Noe, 2009). Moreover, it is essential that this knowledge is distributed throughout the organization, rather than being concentrated solely among those in managerial roles (Machado & Davim, 2019).

To fully use knowledge and competence within the entire organization, a process should not be controlled solely by one individual responsible for carrying it out. Suzaki (1993) exemplifies it as if a separation is made between those who think and those who do manual work, the potential power that exists among all employees is not used to its full potential. By monopolizing on information, the rest of the employees may not understand what is happening, creating a "black box management". This generates less chances of self-control, thinking, and motivation, compared to if a larger number of people had the opportunity to gain skills. Black box management increases the risk of responsible managers ending up "firefighting", dealing with urgent issues that could have been handled more centrally. This takes valuable time away from their core responsibilities. In an organization where the black box management shifts towards a pool of knowledge, the skills broaden among the employees, which may result in that they are able to organize their own work areas and manage themselves. In this scenario, problems will be addressed at an earlier stage and management can focus on bigger issues than firefighting.

To expand knowledge within an organization, Stedt (2013) highlights coordination as an effective way to foster insight and strengthen a team's ability to better understand their work. The definition of coordination is defined as a process in which

two or more individuals create a shared plan of action that they are jointly committed to follow. The research emphasizes that effective coordination requires not only joint task planning and shared intentions but also a sense of belonging among the participants, that is, that they feel like they are part of the same team. Under such conditions, the involved parties can gain a deeper understanding of both what needs to be done and how it should be carried out. In addition, reflective conversations can improve competence both at the individual and organizational levels (Stedt, 2013). The degree to which people engage in meaningful dialogue about tasks and shared goals plays a crucial role in shaping common practices and structures. Through coordination, the individuals involved can reflect on how they perceive their tasks. Through dialogue with others, they can potentially develop a broader understanding of their role within the larger organizational context. They may also see how their actions or lack of actions can impact others in their work. This, in turn, strengthens the team's ability to collaborate and pursue common goals.

Coordination among team members influences both team and organizational outcomes (Kauffeld & Lehmann-Willenbrock, 2012). However, successful teamwork requires regular meetings. These meetings, supported by the participants' expertise, create space for discussing ideas, making decisions, and improving processes. To fully realize this potential, organizations must establish team meetings as a consistent part of the continuous improvement process. Furthermore, meetings that focus on knowledge sharing and problem solving are positively associated with successful team outcomes.

3.6 Process Design with Integrated Feedback Loop

According to Bal (1998), a process is defined as a set of activities that are performed in a specific sequence to give a specified output for a particular operation. Moreover, a process also has a clear beginning and an end, where the inputs and outputs within the process are well defined.

All operations within a company can be visualized through a chain of processes (Suzaki, 1993). To make a process controllable and to be able to take actions on the output of a process, it is necessary that a proper feedback system is integrated from the output of the process into the input of the process. For example, if manpower, machine, and money are set as inputs of a process, the output might be a service, low cost, and high morale. However, the level of effectiveness of the process will not be measurable without the feedback system.

Once a plan has been made, several other possible actions can arise that can change the original plan (Khakee, 1998). These new possibilities create a basis for evaluation. Within planning, there exist two types of evaluation methods: ex ante and ex post. The first type focuses on evaluating from a forward-looking perspective, which means that the expected outcomes of planned actions are addressed and reflected upon before implementation. In contrast, ex post evaluation examines actions after they have already been carried out.

According to Khakee (1998), the concepts "planning" and "evaluation" are inseparable and go hand in hand. Reasonably, a planning process that is somewhat unstable is supposed to have a carefully considered evaluation process. No matter what type of evaluation someone is talking about, the things someone plans today will affect tomorrow and will continue to have an impact in the days that follow. The actual results of an action are compared to what was initially aimed at the beginning, in the form of a target or a set point (Sokovic et al., 2010). When the difference between the result and the aim is identified, a corrective measure is introduced if the gap is too large. This repetitive and continuous method of improvement and control is called the PDCA cycle, which stands for Plan-Do-Check-Act.

The most important part of the PDCA cycle is the Act stage, as this is where actions have been carried out, the cycle begins again, and areas of improvement can be identified (Sokovic et al., 2010). The corrective actions enabled by the PDCA cycle can be divided into two types. The first is a temporary action aimed at achieving a result that matches the intended goal by directly addressing the discrepancy in a practical manner. The second is a permanent corrective action that involves investigating and eliminating the root cause of the problem in order to improve the overall process.

According to Du et al. (2008), the PDCA cycle is a widely used model in quality and control and is a key approach to improve quality within performance management. For the cycle to work effectively, all four phases must be used together and not separated, or it will not function as a continuous process. In addition, improvements in the PDCA cycle can be measured through key performance indicators, which help track progress and evaluate the impact of implemented actions.

4
Empirical Findings

In the following chapter, four cases will be presented. Each case is described by showcasing the workforce planning process. Furthermore, each subchapter will begin with an overview of the respective case. The cases that will be presented are:

- 4.1 Company Alpha Site I
- 4.2 Company Alpha Site II and Site III
- 4.3 Company Beta
- 4.4 Company Gamma

The reason for Site II and Site III being considered the same case is that they are located close to each other in the same industrial area and share the same management structure. Furthermore, the case companies have different names for different roles, such as Supervisors and Operations Managers. To keep the text in this report consistent, people with similar functions at different companies will be referred to with the same title, such as site manager, supervisor, and team leader. However, other titles are not directly translatable and will thus remain. Examples of these are the Warehouse Manager at Company Alpha Site II and Site III, and the titles at Company Gamma.

4.1 Company Alpha Site I

The blue-collar workforce at the Company Alpha Site I averages between 70-80 employees per day, increasing to 100-110 during peak seasons, such as Black Week. Seasonal fluctuations depend on customer needs, where some clients might require significant extra staffing. The permanent internal staff consists only of 30 employees, and to fill the remaining demand, the site is supplemented with workers from five different staffing agencies. The choice of using agencies is the benefit of flexibility, as staffing needs decrease and increase throughout the year. The contracted personnel work solely on an hourly basis at the site and are fully employed by the agencies.

Company Alpha Site I is the company's biggest site in Sweden, storing goods from twelve customers in several different markets. As some customers are in the same market, combined processes have been set up. An example of this is two customers, which are both companies within the automotive industry, supplying parts to a major vehicle manufacturer. Another set of customers, in the clothing retail industry,

has partially integrated processes as they have similar flows in the warehouse. The customers are divided by the supervisors based on size, location in the warehouse, and also weather they share processes with other customer.

The organizational structure at Site I is presented in 4.1. The structure includes Site Manager I, three supervisors and 16 team leaders. The figure also divides the workforce for each supervisor's team. The supervisors are highlighted in gray as they conduct the workforce planning, which is the focus of the report. The number of employees assigned to each supervisor includes their respective team leaders, resulting in an average of 75 blue-collar employees on the site.

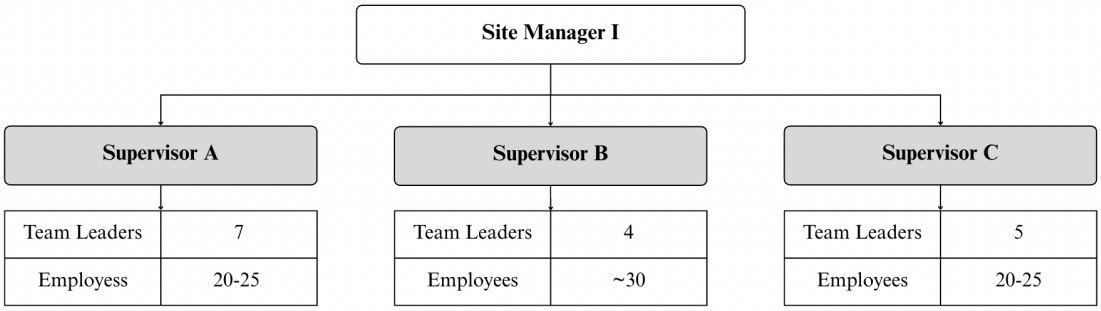

Figure 4.1: *Visualization of the organizational structure at Company Alpha Site I.*

Site Manager I is responsible for overseeing operational activities, customer relations, personnel, and workplace conditions. These duties encompass both short- and long-term tasks, such as ensuring compliance with customer agreements, setting goals with supervisors, planning to meet key performance indicators (KPIs), making real-time decisions, and proactively addressing challenges.

The supervisors at Site I have a broad range of responsibilities, primarily focused on daily operations, workforce management, and KPI tracking for each customer. Included in their responsibilities is conducting operational workforce planning.
Team leaders are primarily responsible for managing the day-to-day operations within their assigned processes or customers. Depending on the size and requirements of each customer, some have a single team leader overseeing all processes (e.g. receiving and order picking, see Section 3.1 to view examples of processes in a warehouse), while others have multiple team leaders managing different processes for the same customer. In some cases, a team leader may be responsible for the same process across multiple customers.

4.1.1 Operational Workforce Planning Process

The current operational workforce planning process at Site I is performed daily by the supervisors for each respective team. The process is divided into six steps, shown in Figure 4.2. The timeline of the process spans over three days. On Day 1, the supervisors review the orders and shipments scheduled for Day 2 and decide how to allocate resources based on the data accessible at this time. Day 2 is dedicated to

the execution, where the plans made on Day 1 are carried out. However, real-time adjustments and reallocation are often made as new information arises throughout the day. On Day 3, an evaluation of Day 2 takes place, where the execution is analyzed to identify what worked well and what could be improved moving forward. The process describes a generalized structure of the process that all supervisors at Site I follow and each supervisor starts this process each day, as it is a daily need. This means that the execution day for one planning process is the same day as the planning and evaluation day for two others.

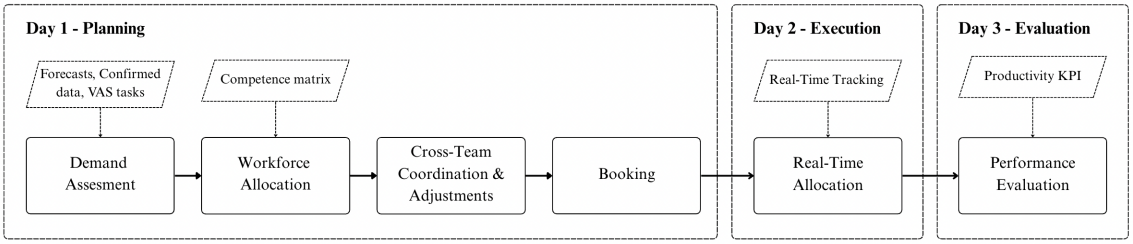

Figure 4.2: *Visualization of the workforce planning process with required data.*

While all supervisors follow this process, the details of how each process step is conducted can differ slightly from supervisor to supervisor. The differences are based on how each customer assignment is structured, what data is available, and at what time these data are available. In the following sub-chapters, the process steps will be presented in chronological order, together with the relevant data that are used in each process step by the supervisors.

4.1.1.1 Demand Assessment

During the first step, data is collected to assess the capacity required for the next day. This data collection is divided into three functions: inbound, outbound, and VAS activities. The available data sets the ground for how well operational supervisors are equipped to plan the workforce for the upcoming day.

The data for the inbound function are solely from confirmed data related to inbound shipments, which are planned by customers. The frequency of inbound shipments is determined by the need for restocking and the release of new products from customers. The strategies of different customers vary; some customers ship large containers, while others send smaller restock deliveries. In addition, certain customers choose to fill their inventory in advance to prepare for the peak season, while others maintain a more stable restocking pattern throughout the year. To help supervisors stay informed about planned shipments, there are inbound logs for each customer. Shipments are typically declared between two weeks and 24 hours before arrival, providing supervisors with confirmed data for daily workforce planning. Inbound logs usually specify which purchase orders are included in each shipment, making it easier to estimate the number of workers needed for the intake. However, Supervisor A emphasizes that shipments frequently arrive earlier, later, or not at all compared to what was declared, making it harder to plan for.

The primary data considered for the outbound function by supervisors includes forecasts and confirmed figures, such as placed orders and planned outbound shipments. For some customers, outbound shipments have both forecasts and confirmed figures. The use of customer forecasts for outbound shipments is used by Supervisors A and B, while Supervisor C does not receive any forecasts from the customers. Supervisors A and B explain that the forecasts provided by their customers are handled with caution, as the forecast may, at times, not comply with the confirmed data. Customer forecasts are typically provided in different formats depending on the customer. Some customers offer long-term forecasts that span several months at a less detailed level, while also providing more detailed forecasts for each day. Some customers only provide weekly forecasts and do not specify for which day of the week the demand is needed. The degree of reliance on customer forecasts depends on historical outcomes and the level of detail provided in the forecast. If significant discrepancies have occurred in the past, the forecasts are treated more as a guide rather than being strictly followed.

The confirmed data for outbound orders is provided by customers and found in the Warehouse Management System (WMS). The orders are provided at different cut-off times, which vary for each customer. The cut-off time is typically in the morning or early noon on the day of execution (Day 2) for Supervisor A and Supervisor B, while for Supervisor C, it is set at 16:00 on the planning day (Day 1). Supervisor C relies solely on confirmed data for workforce planning, as its customers do not provide any forecasts. This means that planning is only done after the cut-off time. In contrast, the cut-off time for Supervisors A and B is too late, forcing them to rely on customer forecasts to plan ahead.

The VAS function includes reviewing the different VAS assignments requested by the customer to complete. Some of these tasks are integrated into standard process tasks, while others require additional work, such as inventory checks. The decision to carry out VAS assignments depends on the deadline and whether the task needs to be done immediately or can be scheduled for a later time. Usually, if there is no immediate rush in doing the VAS work, it is saved as buffer work for days when there is less to do. However, if a VAS assignment is close to a deadline, an operational supervisor will integrate the assignment into the normal schedule.

According to all supervisors, the standardized method for calculating the personnel required with respect to the three functions inbound, outbound, and VAS activities can be determined using formulas 4.1 and 4.2, as shown below.

$$\text{Hours} = \frac{\text{Forecast or Confirmed Order lines}}{\text{Productivity KPI}} \tag{4.1}$$

$$\text{Personnel Required} = \frac{\text{Hours}}{\text{Time per Person}} \tag{4.2}$$

with:

- Hours = How many man-hours a process needs to accomplish all order lines
- Forecasts or Confirmed Order lines = The given order lines for a process
- Productivity KPI = A standard of how many lines can be done in one hour
- Personnel Required = How many workers are needed to complete the order lines
- Time per Person = How many hours one worker can work each day

These formulas are a standardized method known by all supervisors and is used as a general rule. The formulas mentioned serve as the foundation for the estimations. However, exceptions are made when a specific productivity rate has not been defined for a task or when it is clear from the outset that the set target is unachievable. For some processes, it is difficult to determine the time it will take for an activity to be accomplished. An example of this is the picking process. Picking an order of ten order lines can require a longer or shorter time depending on the size, weight or warehouse location of these products. Further, one order line can consist of one piece or 100 pieces of the same product. Therefore, estimating an average time for this is difficult, as that time can vary from order to order. As the productivity goal for each process is calculated using an estimated time for that process, this is challenging.

4.1.1.2 Workforce Allocation

In the next step, workforce allocation, the supervisors ensure that the necessary workforce capacity for each process the following day exists. While all supervisors have a general understanding of their workers' competences across different customers and processes, their approaches to this step vary. A shared competence matrix covering both internal and external shop floor employees at Site I.

The competence matrix, developed by Company Alpha, is used with the support of Excel to assign personnel to different tasks. This matrix allows the operational supervisor to assess the type and number of tasks an individual can perform independently and reach the range from a "new employee" to an "expert". This tool helps the supervisor better understand the number of competencies that exist within the warehouse. If an employee is proficient in multiple tasks, it becomes easier to assign them as needed. The competence matrix also provides valuable information in terms of training, making it easier for the operational supervisor to visualize if and when an employee should be trained for a new task or if the employee can be cross-trained. For example, if an employee knows how to use *scan by barcode* in one customer task, the employee will be able to do it in another customer process as well. One supervisor highlights the value of the matrix with an example: if a key employee with expertise in a specific process is absent, the matrix helps determine how to reallocate resources to cover all processes.

Some supervisors use a simplified version of the matrix, which only indicates the customer or main process an employee typically works with, rather than specific

competence levels or activities. In cases where the competence matrix is not used, the supervisor relies on their own knowledge, or team leaders' knowledge, to manage rotations. The team leaders are believed to have enough insight into which employees possess specific competences.

4.1.1.3 Cross-Team Coordination and Adjustments

The main activity in the cross-team coordination step is a daily meeting between the supervisors and the site manager. This initiative was recently introduced by Site Manager I to improve collaboration within the workforce planning process. During the meeting, the supervisors discuss their workforce planning for the coming day, including whether they need additional personnel or have excess personnel. This coordination helps streamline workforce adjustments, preventing miscommunication with the staffing agencies, where one supervisor cancels a worker while another supervisor requires an extra. The meeting is scheduled at 14:15 to ensure that the supervisors have completed the previous two steps in the process, as some data is not accessible earlier. After the cross-team coordination meeting is done, the supervisors adjust their plan accordingly.

The largest customer of Supervisor C, does not provide any forecasts. Additionally, the cut-off time for this customer is as late as 16:00, resulting in Supervisor C not contributing to the same extent as the others, relying solely on estimations at this stage.

4.1.1.4 Booking

The fourth step involves confirming the plan, where external personnel from staffing agencies are scheduled or released as needed. This is then communicated to the staffing agencies, who perform the actual booking of the external staff.

4.1.1.5 Real-Time Allocation

The fifth step in the workforce planning process is real-time allocation. During live production, the productivity of each process is continuously monitored using red, yellow and green indicators to visualize whether processes are on track or falling behind time schedule. This monitoring is done using the Production Monitoring System (PMS), which is integrated with time-tracking terminals, where each employee is required to register task changes by clocking in and out accordingly. If the indicator is red, the productivity is too low, yellow means that the process is close to falling behind the productivity goal and green means that the process meets or exceeds the productivity goal. The PMS is displayed on screens around the warehouse, where the workforce can see these indicators. Moreover, the PMS provides an overview of the remaining orders for both the current day and the following day. This allows supervisors and team leaders to monitor the workload and assess the required capacity more effectively.

Throughout the day, the supervisors oversee the production and collaborate with the

team leaders to make any necessary adjustments in real-time. These adjustments can entail staff changing tasks or processes within each team leaders' teams or within the supervisor's team. These adjustments are, according to the supervisors, very common and occur several times a day. One reason for these adjustments can be, e.g., sick leave. Moving staff between different supervisors' teams, however, occurs less often. On some occasions, it is also possible to get an overview of the upcoming tasks for the next working day through the PMS, this information depends on how many orders have been placed after the cut-off time.

4.1.1.6 Performance Evaluation

The following day, Day 3, the results are analyzed by the supervisors by extracting reports from the PMS, which show the extent to which the previous day met the defined KPIs. If the results are exceptionally good, an investigation is conducted to identify the factors behind its success. A similar investigation is carried out if performance is poor. Notable is that performance is affected by more factors than the original workforce planning made on Day 1, see Figure 4.2. During Day 2, the execution phase may face unforeseen issues that were not considered during the workforce planning on Day 1, requiring staff rearrangements. As a result, the outcome of the workforce planning process can differ from what was originally planned. This makes the extracted data from the PMS an unreliable indicator of whether the initial workforce planning was effective.

The previous day's performance is also reviewed during shop-floor meetings. Team leaders first discuss the results with their teams before presenting them in a meeting with their supervisors. In these discussions, the supervisors may look into the reasons behind any particularly strong or weak performance. Following this, supervisors meet with the site manager to report the day's numbers.

4.2 Company Alpha Site II and Site III

Company Alpha has two sites that are placed fairly close to each other in the same industrial area. These sites are bound together with the same management, which can be seen in Figure 4.3. Site Manager II manages both sites, together with the Warehouse Manager. Together, about 60 blue-collar employees work at the two sites, and the vast majority are hired through staffing agencies. According to Site Manager II, the strategy is to hire employees who hold responsibilities, such as team leaders, and otherwise hire them through the agencies. Therefore, there are seven employees who are hired directly by the company at the moment. Site Manager II, similar to the one at Site I, is responsible for ensuring that customer agreements are met, setting strategic goals, and creating the right conditions for staff and performance over time. The organizational structure at Site II and Site III differs somewhat from the structure at Site I, particularly in the role and scope of responsibility assigned to the Warehouse Manager, a position that does not exist at Site I. The Warehouse Manager has comprehensive responsibility for the overall operations across both warehouses.

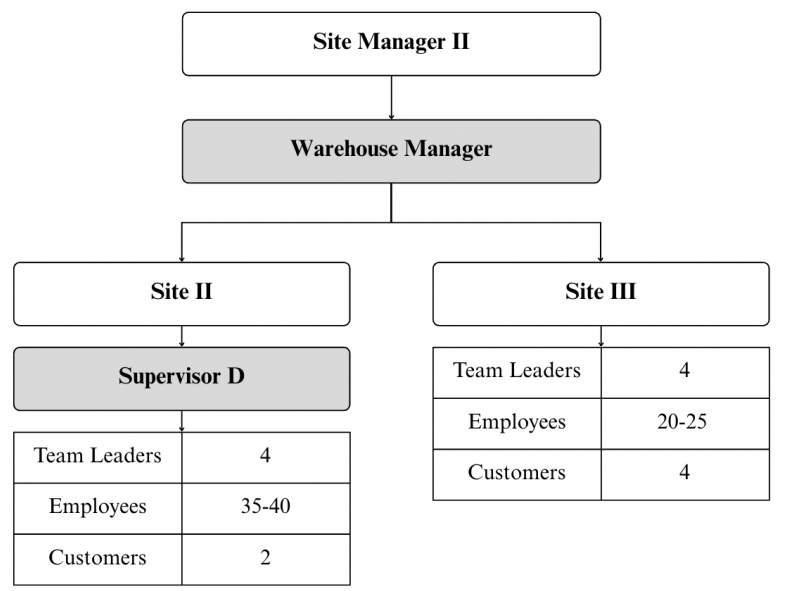

Figure 4.3: *Visualization of the organizational structure at Site II and Site III.*

Site Manager II, similar to the one at Site I, is responsible for ensuring that customer agreements are met, setting strategic goals, and creating the right conditions for staff and performance over time. The organizational structure at Site II and Site III differs somewhat from the structure at Site I, particularly in the role and scope of responsibility assigned to the Warehouse Manager, a position that does not exist at Site I. The Warehouse Manager has comprehensive responsibility for the overall operations across both warehouses.

Highlighted in gray in Figure 4.3, the warehouse manager is also responsible for personnel management, including workforce planning at both sites. At Site II, Supervisor D is involved in this process, while at Site III, the Warehouse Manager solely performs the operational workforce planning. Supervisor D's role is similar to the supervisors at Site I, with responsibilities for daily operations, workforce management, and KPI tracking. Again, similar to Site I, the team leaders at Site II and Site III are managing their respective processes or customers.

At Site II, about 35-40 employees work in the daily operations divided into two teams. For one of the customers, only two workers are required daily and make up for one team. This customer is easy to handle, with a simple pallet-in, pallet-out flow. The rest of the workforce at Site II is placed to work in the team operating for the other customer.

At Site III, the workforce of about 20-25, is spread across four customers, with the majority assigned to processes related to two of the customers. Due to the similarity of their operations, these two customers share a combined workforce group. In contrast, the other two customers have distinct processes that require separate staffing. One of these customers has minimal operational needs and typically requires less than one full-time employee per day.

An important characteristic of the customers at Site III is that seasonal variations are minimal. The vast majority of orders at this site is industry supply or spare parts within the automotive sector and are therefore not affected by any seasonal or promotional fluctuations. Fluctuations are instead driven by changes in the industry rather than by seasonality. At Site II, the major customer has peak season during spring and summer, due to the nature of their products.

4.2.1 Operational Workforce Planning Process

The workforce planning process at Site II and Site III can be divided into four steps as shown in Figure 4.4. This process is done daily by the warehouse Manager for Site II and in collaboration with Supervisor D for Site III. The timeline is similar to the process at Site I, as described in 4.1.1. However, no adjustments are made after cross-team coordination due to that the workforce allocation already is done in the same step. Further, no evaluation is done at Site II and Site III. A detailed explanation on how each step is conducted is presented in this chapter.

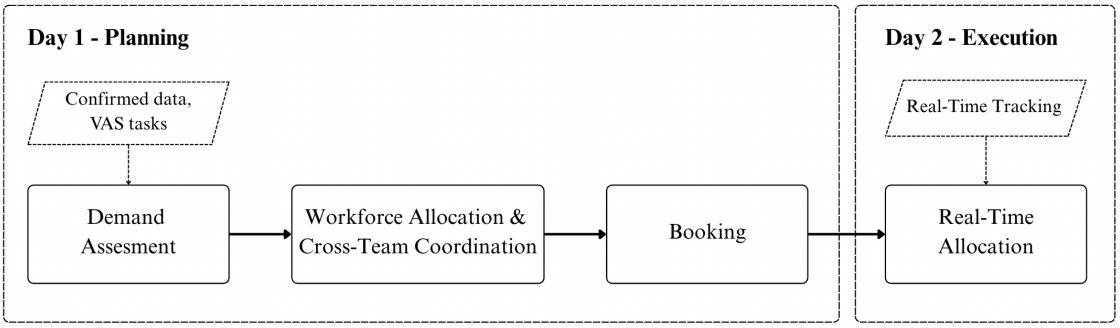

Figure 4.4: *Visualization of the workforce planning process at Site II and Site III with required data.*

4.2.1.1 Demand Assessment

In the first step of the workforce planning process at Site II and Site III, the Warehouse Manager and Supervisor D collect input data from the PMS. The PMS provides a list of all available orders for each department, offering an initial overview of where tasks need to be completed. Following this, the Warehouse Manager and Supervisor D use WMS to gain a more detailed visualization of the orders. This step is essential because even small orders can be complex, while larger ones may not necessarily be, as the complexity of the order is not correlated to the size. By reviewing this information, the Warehouse Manager and Supervisor D can assess the complexity of the tasks to be planned. After the data are collected and analyzed from PMS and WMS, a comprehensive understanding of the required workload is established. It is important to note that the sites do not receive customer forecasts and operate solely based on confirmed data for both inbound and outbound shipments.

Furthermore, the Warehouse Manager has a discussion with the team leaders at Site III twice a week to get an overview of the data that cannot be collected through the available systems. For Site II, Supervisor D receives this information on a daily basis from the team leaders. Data that cannot be extracted from WMS or PMS is, for example, VAS work or maintenance of the facility. Supervisor D maintains a closer relationship with the team leaders, which results in a greater degree of influence from their input during the planning process. For example, at Site II, a specific team leader is responsible for managing inbound shipments. Due to the close working relationship between Supervisor D and this team leader, daily staffing recommendations for the inbound function are often communicated directly to Supervisor D. However, Supervisor D makes the final decision regarding whether the inbound function receives the requested number of personnel or if another process is prioritized.

Once the upcoming workload has been determined, the tasks are prioritized. According to the Warehouse Manager and Supervisor D, outbound flows are always given priority, as it directly impact the service level. For example, if there is a high workload for both inbound and outbound shipments, inbound goods will be scanned upon arrival but will not necessarily be unpacked until outbound shipments are under control. Site III receives the largest volume of inbound shipments and also has available space on the shop floor. Thereby, it is possible to scan the products upon arrival and postpone unpacking and storing it, as the goods can be temporarily placed on the shop floor without the need for immediate storage. If a new customer were to be onboard at Site III, this flexibility would be reduced due to limited space. The current availability of space is mainly because the site is relatively new, having only been in operation for two years.

4.2.1.2 Workforce Allocation and Cross-Team Coordination

When all the data described above have been collected, the Warehouse Manager and Supervisor D plan the allocation of personnel together. This takes place at 14:15, which is when the majority of orders have been released. Notable is that although Supervisor D primarily oversees Site II, the Warehouse Manager holds a higher position and therefore has the final say in all decisions, see Figure 4.3 for a more comprehensive view of the hierarchy.

The Warehouse Manager and Supervisor D have a discussion on how to divide the personnel between sites. This meeting may take place by phone or in person, depending on the location of the Warehouse Manager that day. During this meeting, the Warehouse Manager and Supervisor D express the upcoming demand for each process at the different sites. When the demand is established, the personnel are moved accordingly, depending on demand and the level of importance of the task. As described in Section 4.2.1.1, all processes have a level of priority in relation to the other processes.

The Warehouse Manager expressed that up to 80% of the employees are capable of working in multiple processes or customers due to the high level of cross-training,

which has allowed a high level of flexibility when rotating the shop floor staff. This cross-training is not limited to a specific site or time of the day, which means that personnel are trained to be able to transition between both locations and across different processes throughout the day. Relocating personnel within a single workday is explained as not being a standard practice, but having the option to do so provides valuable flexibility when necessary. In addition, Supervisor D indicated that a competence matrix exists, revealing the competence levels of the staff in different processes. However, this competence matrix is not used actively as Supervisor D and the Warehouse Manager consider the team to be small enough to track each employee's competence level mentally.

4.2.1.3 Booking

The next step in the workforce planning process is the actual booking of external personnel. In contrast to how Site I schedules the needed capacity for each day, Site Manager II and Warehouse Manager have taken another approach. Although demand varies from day to day, they have decided to retain all staffing agency employees even during lower demand periods. The site manager believes that frequent cancellations can lead skilled and valuable workers to seek other job opportunities. To be able to do this type of arrangement, the majority of VAS jobs and less prioritized activities are intentionally saved for days when there is less to do. Likewise, on days when there is much to do, no additional personnel is brought in. Instead, the focus is solely on completing the most critical tasks.

However, a booking of external staff needs to be made for each day due to contracts with the staffing agencies. This booking does not change from day to day.

4.2.1.4 Real-Time Allocation

On the day of execution, when planned activities are carried out, the operation is overseen by Supervisor D at Site II and the Warehouse Manager at Site III. In cases of unexpected sick leave, no additional staff is brought in, instead, personnel might be moved from one site to the other to conduct the prioritized assignments for the day. Instead, the outbound flow, as described in Section 4.2.1.1, will be prioritized. Further, when the sites are understaffed, VAS activities are postponed to maintain the prioritized operational flows. These decisions are made in real-time by the Warehouse Manager.

Live production is monitored through the PMS, which displays real-time productivity data using color-coded indicators and tracks employee placements, in the same way as the setup at Site I, explained in Section 4.1.1.5. This system also allows the Warehouse Manager to continuously track performance and identify the needs for workforce adjustments. Inbound and outbound shipments are also closely monitored to ensure that it follow the time schedule. When staffing exceeds capacity requirements, the time is utilized to begin picking orders scheduled for the following day or to perform VAS activities.

4.3 Company Beta

Company Beta is a TPL provider with several different services. However, this empirical study will focus on the company's warehouse facility. Therefore, any references to Company Beta in this report is exclusively referencing this warehouse and its operations.

The warehouse has a core internal workforce of 15 full-time employees, excluding management, supervisors and other administrative roles. To maintain flexibility, the company relies on internal hourly workers to manage the daily fluctuation in demand. These hourly workers are not guaranteed work each day, however, about 10-15 are utilized on a daily basis. Additionally, about five extra hourly workers are scheduled on Mondays, as it is the busiest day of the week. These hourly workers are usually utilized for eight-hour shifts, however, it is possible to schedule them for four hours as a minimum. The workforce of blue-collar employees on regular days is thus between 25-35. During peak season, which runs from Black Friday to Christmas, the workforce expands to around 100 workers.

The warehouse organization is structured as shown in Figure 4.5, where customers are divided between the two supervisors primarily based on whether they are B2B or e-commerce (B2C). In total, the company has 18 customers, with Supervisor E responsible for 10 B2B customers and Supervisor F overseeing 8 e-commerce customers. The supervisors and the team leaders are highlighted in gray in Figure 4.5, as they are primarily involved in the workforce planning process.

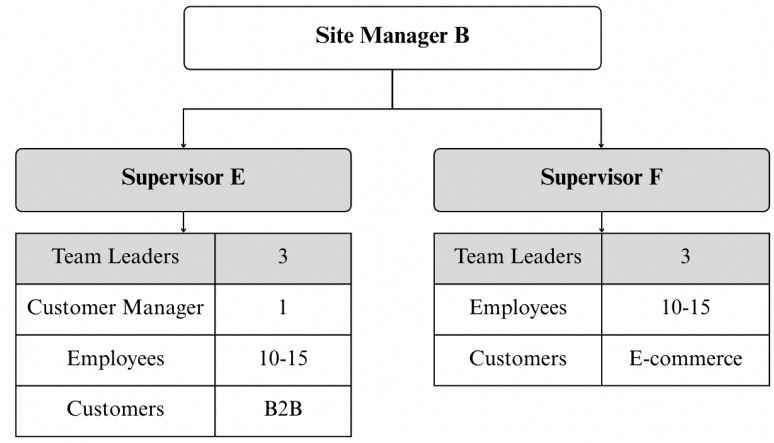

Figure 4.5: *Visualization of the organizational structure at Company Beta.*

The supervisors have team leaders reporting to them, including one customer manager reporting to Supervisor E. The Customer Manager is responsible for several smaller customers and handles both administrative and operational tasks in the warehouse, however, does not have any employees reporting to them. The team leaders, in contrast, manage a team of workers and may be responsible for all processes related to one or several customers, or exclusively for the inbound or outbound

flow across multiple customers.

4.3.1 Operational Workforce Planning Process

The operational workforce planning process at Company Beta is primarily managed by the two supervisors, in close collaboration with the team leaders. Planning is conducted on a daily basis, but an initial schedule is created ahead of each week and then adjusted daily. Each supervisor is responsible for planning within their respective customer segment, but they follow the same overall process structure. However, they may carry out the steps within this shared structure in different ways. The workforce planning process is visualized in Figure 4.6.

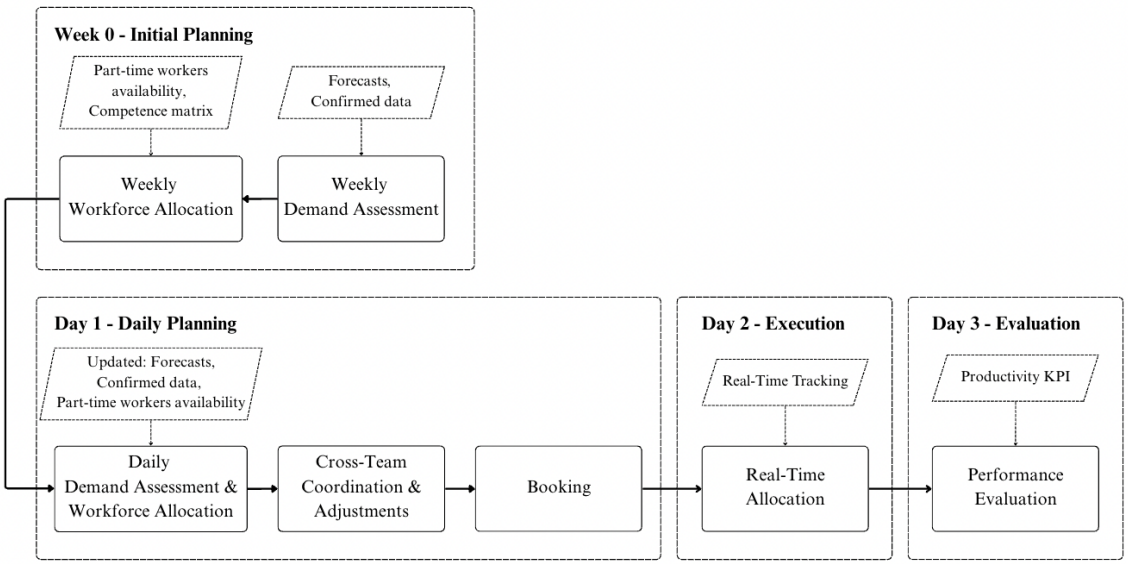

Figure 4.6: *Visualization of the operational workforce planning process at Company Beta with required data.*

The planning process begins with the creation of an initial plan for the upcoming week. This is carried out during the week prior to execution and serves as the foundation for the daily planning that follows. Each week, a weekly initial plan is prepared to support execution activities taking place from Monday to Friday of the following week. If the initial plan is created on a Friday, it is immediately followed by the steps Cross-Team Coordination and Adjustments, and Booking, as Friday is considered Day 1 in preparation for execution on the upcoming Monday (Day 2). Supervisor E conducts this initial plan in close collaboration with the team leaders, while Supervisor F conducts the demand assessment themselves. Then, let the team leaders be more involved in the allocation of the staff. Thereafter, this plan is adjusted the day before execution (Day 1) when there is more reliable data available.

4.3.1.1 Weekly Demand Assessment

The first step is to review the different data sources to assess the demand. Supervisor F receives structured forecasts from the e-commerce customers, which are often organized in shared folders and are updated daily. The forecasts include projected order volumes, expected order lines and any campaign information. In general, this information is reliable enough for an initial plan, but will be updated closer to the execution date.

In contrast, Supervisor E receives fewer structured forecasts from the B2B customer segment. Some customers provide long-term estimations based on monthly demand. These are, in contrast to Supervisor F's forecasts, unreliable and inaccurate according to the supervisor. As a result, the weekly planning is more reliable on historical volumes and practical judgment. In cases where the customers do provide more structured forecasts, they are handled with caution and cross-checked with the internal estimations. Supervisor E has a strong overall understanding of the customer patterns but also relies heavily on the team leaders, who have a greater visibility of the volumes and process flows. This combination forms the basis of the data input that is further used in the next step regarding the outbound shipments.

In addition to order forecasts, both supervisors consider inbound shipments in their initial plan. Those customers who rely on container deliveries or slot-booked inbound flows have their shipments scheduled well in advance. This makes it possible for the supervisors to plan for the handling of container unloading on the booked delivery day.

However, smaller deliveries can arrive without any prior notice and are thus hard to plan for. This can be exemplified by a customer of Supervisor F, who has access to a system shared with the customer where purchasing orders can be viewed. The order date and the size of the order are visible, but no information is provided regarding the expected arrival. As a result, Supervisor F has a general overview of what deliveries are expected, but not on which day they will be received. Therefore, these deliveries are often excluded from the initial plan, and are instead handled once they arrive at the site.

Based on the gathered demand, the supervisors can estimate how many working hours are needed. Company Beta works, just like Company Alpha, with productivity goals for each process and customer, which makes it easier to translate order volumes or task quantities into working hours per process. However, Supervisor E highlights the difficulty of having productivity goals for all processes, especially the more complex ones. For processes without fixed productivity targets, it can be hard to estimate the time needed to handle the volume. In addition, the time it takes depends on who performs the task. Therefore, planning these processes accurately is difficult and depends on the supervisors' and team leaders' knowledge of how fast each worker performs different tasks. Therefore, the more complex processes require estimations of the needed personnel.

However, for most of the processes, the calculation follows a similar approach as the one used by Company Alpha Site I and is carried out for each day for the upcoming week, based on the demand for the respective day. Thereafter, this is translated into how many workers are needed in each process.

4.3.1.2 Weekly Workforce Allocation

Step two in the workforce planning process at Company Beta is when the personnel is allocated to specific tasks and processes. Supervisor E continue the collaboration with the team leaders, who are already familiar with the upcoming week's demand, and supports the assessment of which workers are best suited for each process. This allocation is discussed, and then compiled by Supervisor E to be reviewed again prior to the confirmation day.

Further, Supervisor F, who conducted the demand assessment independently, also involves the team leaders in this step of the process. The required number of hours for each process for the upcoming week is provided to the team leaders, who then make suggestions on which personnel should be scheduled for which process. These suggestions are based on their knowledge of the workers and the plan is adjusted after it. Notably, even though a team leader prefers a specific worker for a task, it is ultimately up to the supervisors to make the final decision.

The availability of the hourly workers is tracked in Excel, where the workers can indicate their availability for the upcoming weeks. This availability spreadsheet is used by both the supervisors and team leaders when conducting the scheduling. In addition, Company Beta has a competence matrix, which is particularly relied on during peak seasons when there is many temporary workers on the site. The matrix is similar to the one used at Company Alpha, with a clear context of which worker has the competence of different processes at different customers, or if they have a forklift license. During periods of lower demand, the matrix is not used as often, as the supervisors and team leaders are aware of each worker's skills.

The allocation of the core staff is also done in this step. Since the number of available hourly workers exceeds the actual staffing need the supervisors take in account the need for rotation of the workers, ensuring that the work is spread out evenly among the hourly worker pool. Further, the process rotation for workers are also important according to Supervisor F, especially the hourly workers who do not work every day. Rotation between processes and tasks helps hourly workers maintain their skills and prevents them from forgetting how to perform certain activities.

The initial plan is then kept by the supervisors and serves as a basis for the following steps in the workforce planning process.

4.3.1.3 Daily Demand Assessment and Allocation

Although the initial plan is in place, each afternoon the supervisors gather their respective team leaders and customer managers to assess the demand for the up-

coming day. This step mirrors steps one (Chapter 4.3.1.1) and two (Chapter 4.3.1.2) on a smaller scale, as it involves adjustments to the initial plan that has been made. The data that the initial plan is built upon has been updated. In Supervisor F's case, where the forecasts from the customers are reliable, new updates have been made, which are taken into consideration. For Supervisor E, more confirmed orders have been added into the WMS, which allows a more detailed recalculation of how many hours are needed.

Both supervisors conduct this step in collaboration with their team leaders and customer managers. The supervisors allow the team leaders to take a more central role in the daily planning. They can request additional hours, excluding the calculated demand, for any additional assignments such as extra VAS work the following day. In this meeting, a customer manager might add how he or she has tasks that exceed or fall short of their working hours. In most cases, the Customer Manager can help out in other processes for some time, which is then added to the daily plan. While the team leaders and customer managers are most involved in the allocation, the supervisors make the final decisions regarding number of workers required and where they are to be allocated.

4.3.1.4 Cross-Team Coordination and Adjustments

After each supervisor has updated the daily plan together with their team leaders and customer managers, the supervisors have a quick coordination check with each other. This is usually an informal discussion held to align their workforce plans. While the hourly workers enable shorter working days, with a minimum of 4 hours, the supervisors might indicate a need to "share" an employee, who can work a few hours in Supervisor E's team, then switch to Supervisor F's team. In cases where this is necessary, the plan is adjusted accordingly.

4.3.1.5 Booking

Booking is the final step of the planning phase of the workforce planning process. The final staffing plan for the upcoming day has been agreed upon and finalized. This step is done to confirm and communicate the plan to the workers. The plan is forwarded to an administrator at the company by the supervisors, who then proceeds to reach out to the hourly workers and confirms the booking.

The administrator sends out a booking of the hourly workers, either a full shift or shorter shifts, depending on the need. The minimum shift length of a hourly worker is generally four hours. While the hourly workers receives their schedule for the upcoming day, they are not informed of the specific processes or tasks that they will be assigned to. This is instead communicated when they arrive at the site the next day.

4.3.1.6 Real-Time Allocation

Once the workday begins, the supervisors pass over most of the responsibilities to the team leaders. Several changes to the workforce plan can occur during the day, which require adjustments to the plan. In the morning, the supervisors have pulse meetings with their team leaders and customer managers, in which they discuss changes that have happened or are to be done to the plan.

The disruption that the supervisors is most involved in is when employees call in sick, which they have to do at least one hour before their shift starts. The supervisors then assess whether the absent worker's tasks can be divided and managed by the existing staff or if an additional hourly worker should be called. This decision is often managed by the supervisor together with the team leaders, who then make the necessary adjustments.

Throughout the day, the team leaders monitor the processes through a dashboard that they have access to on the computers in the warehouse. This dashboard is similar to Company Alpha's PMS and provides an overview of the daily operations. The team leader can thus assess if the initial plan is still manageable or if any changes need to be made. For example, if a process is progressing slower than expected, decisions to relocate a worker from another process might be needed. If, instead, a process is finished ahead of schedule, the worker can be moved to another task.

In cases where no other processes are in need of extra staff, the worker is moved to a VAS process done for one of their customers. This process involves opening packages that contain a large number of products to then re-package the products in smaller packaging. Since this process never runs out, it is used both as a "buffer" task and also has dedicated staff scheduled for it regularly. Another solution to an overstaffed workday is to offer the hourly workers to leave early.

Real-time adjustments are, according to the supervisors, common and are usually handled by the team leaders. However, the supervisors get involved in cases where the team leaders are unsure or require consulting. When adjustments are needed, the team leaders first explore the opportunities within their own team or with the other team leaders under the same supervisor. Thereafter, they might proceed to speak with the team leaders of the other supervisor to find a solution.

4.3.1.7 Performance Evaluation

During the same pulse meeting where the supervisors, team leaders and customer managers discuss the day's changes, they also touch upon the previous day's outcome. Included in the discussion are topics such as whether the staffing was sufficient, if productivity targets were met and if any unexpected challenges occurred. Additionally, Supervisor F compares the order outcome to the forecasts, to keep track of the provided forecasts accuracy. Supervisor E also tracks the outcome, to enable the self-generated forecasts that are used for customers without provided or reliable forecasts.

Neither supervisor have a formal evaluation point to assess whether or not the initial plan was efficient. However, in cases where team leaders report an overstaffed day without unexpected causes, the supervisors investigate which calculation and or estimation, that was done in the planning stage, was inaccurate.

4.4 Company Gamma

Company Gamma's warehouse operates as an internal distribution center, handling logistics for its own operations, that is, stores and e-commerce. This means that the main focus is on managing their own goods rather than operating as a third-party logistics provider. However, Company Gamma is currently in the process of evolving into a TPL provider beyond their own operations. Currently, they serve one external customer, functioning as both a central warehouse and a distribution on their behalf. Company Gamma's warehouse can be divided into three main logistic departments: inbound, outbound, and e-commerce.

The organizational structure, visualized in Figure 4.7, consists of three department managers and eleven team managers, all highlighted in gray as they are most involved in the planning process. Every team consists primarily of 20-25 staff members per team manager. Thus, this number increases during the peak season, with around 120 employees in total across the entire shop floor. The peak seasons occur during summer and black week. Below the team managers, there exist a number of production administrators. These production administrators are a mix between blue- and white-collar employees, meaning that these employees shift daily between operational work on the shop floor and administrative work. The aim of production administrators is to relieve the burden of the department and team managers, providing them more room to focus on workforce planning.

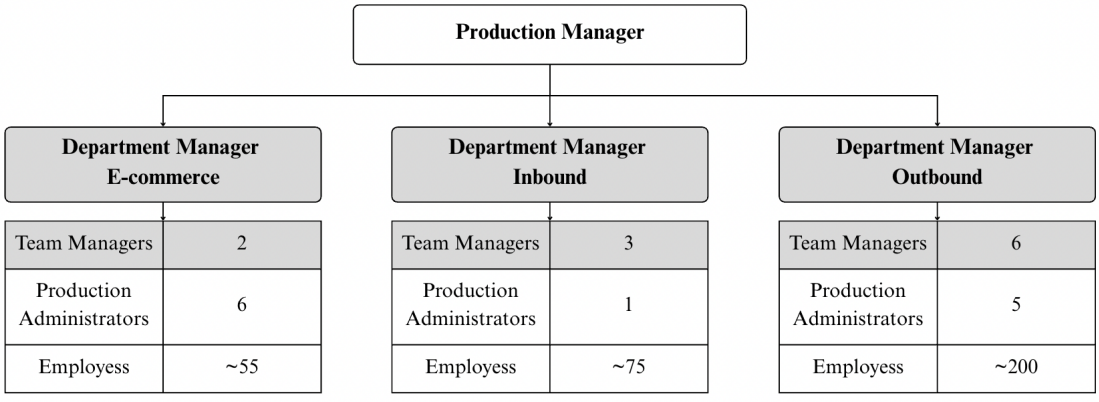

Figure 4.7: *Visualization of the organizational structure at Company Gamma.*

New employees can be divided into two categories: fixed-term employees and summer workers. The significant difference between these two categories is the length of

the contract. For fixed-term employees, employment starts early for the upcoming peak season in the summer, sometimes as early as January. They are offered fixed-term contracts that last until the end of August. Summer workers, which are usually students, start their employment in connection with summer break and are hired until the end of August. This method of hiring has allowed the company to reduce its reliance on other forms of staffing, such as hourly workers, by ensuring sufficient coverage during periods of high demand. This means that once the summer peak comes to an end, the company has the flexibility to let all contracts expire if there is no ongoing need for additional personnel. However, in recent years, the increasing demand has often led to the extension of fixed-term contracts. Moreover, since Company Gamma does not employ hourly workers, summer employees are usually rehired during other peak periods, such as Black Friday.

4.4.1 Operational Workforce Planning Process

For Gamma, operational workforce planning is closely linked to long-term workforce planning. To understand the operational planning process, it is important to first provide a brief introduction to the long-term workforce planning. The long-term workforce planning is developed from budget data created by the purchasing department. The budget is used to calculate the total number of hours of workload that is needed per department. This budget is prepared annually, but the data is available on a monthly basis. These hours then generate the number of full-time employees required on the shop floor. The Production Manager reviews this budget data to estimate how much personnel Company Gamma needs to hire to meet the monthly targets. Moreover, the new personnel requirements will be compared with last year's staffing levels to estimate if there are any differences in demand or if any visible trend can be seen. The Operational Workforce Planning Process at Company Gamma can be divided into five steps, which are shown in Figure 4.8.

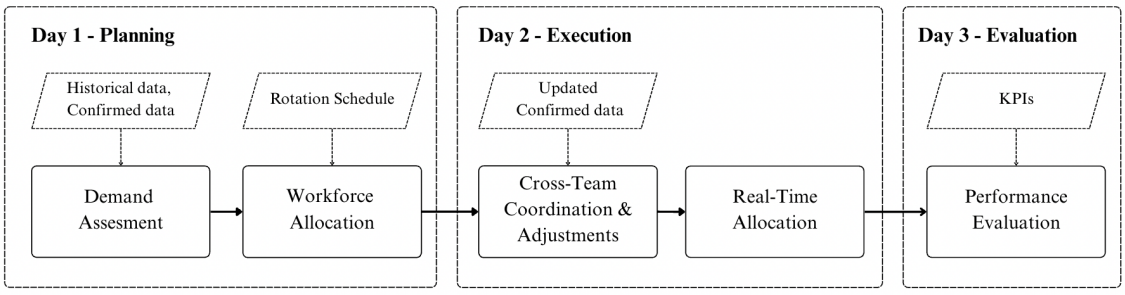

Figure 4.8: *Visualization of the operational workforce planning process at Company Gamma with required data.*

Team managers are primarily responsible for the Operational Workforce Planning Process, particularly through their direct contact with shop floor personnel. The department managers take on a more supportive and supervisory role toward the team managers. However, in certain stages where the workforce planning process shifts from being purely operational to a more tactical level, department managers become more actively involved and help the team managers. The steps of which

the department managers are involved in the different steps will be described in respective subchapter.

4.4.1.1 Demand Assessment

In the first step of the Workforce planning process, the department manager collects data on the expected workload for each process within the department for the upcoming day. This analysis is done with help from historical data and confirmed data, but is complemented with judgments that are based on experience. The confirmed data comes from customer orders placed through e-commerce, as well as orders submitted by the company's own retail stores.

The historical data allows the department manager to review annual, weekly, and daily trends to pinpoint peak periods, determine whether current workloads match past patterns, or identify whether demand this time of year is different than expected. Moreover, efficiency data per work task is used to calculate the time needed for all different processes. For example, the difference in efficiency between the auto store and manual picking affects how many people are needed in every specific process.

In addition, the confirmed data is collected through the company's WMS to see the current number of orders, review the order lines, track how many have been picked, and see what remains for the day. The goal of the demand assessment is to create a forecast that is as accurate as possible, indicating how much labor is required, where it is needed, and when.

To further help create a forecast, Company Gamma uses a forecasting tool that generates predictions based on order data, staffing levels, and budget. Managers input the estimated number of available staff for the following day, and the tool provides a suggested plan. The goal is then to meet that forecast, but since it is heavily dependent on actual staffing availability, it can be difficult to manage through strict targets.

4.4.1.2 Workforce Allocation

After estimating the demand for the next day, the workforce can be allocated accordingly. The allocation of staff is determined by the team manager, who has the best understanding of the skills and competencies of each individual. Although Company Gamma lacks a formal competence matrix, the Team Manager stated during the interview that a team manager knows its staff members. Furthermore, the Team Manager elaborated on the example by mentioning that if a team manager gets sick and cannot do the allocation of staff, either the production administrators or the department manager can step in to fulfill those responsibilities.

According to Company Gamma, rotating personnel between tasks is essential to develop a broad competence base and ensure that staff can easily cover different roles when needed. Rotation occurs both within the staff members own department

and also across other departments. Team managers are responsible for scheduling these rotations, which typically occur daily and sometimes multiple times per day. Although the company's goal is for every employee to be able to work anywhere in the warehouse, individual preferences can make this difficult in practice. The Production Manager explained during the interview that all new hires begin by learning the picking process. This process has the highest workload at all times, and it provides a foundational understanding of how the entire warehouse operates. By working at the pick station, each team member is exposed to all available products and learns how each area should function.

4.4.1.3 Cross-Team Coordination and Adjustments

On the morning of the execution day, when personnel allocation is complete, a meeting is held at 08:30 with all department managers. The purpose of this meeting is to allow managers to discuss the current status of their teams. If another department requires additional staff, personnel may be reallocated accordingly. Thus, in cases of staff shortages, the Production Manager decides which processes to prioritize.

4.4.1.4 Real-Time Allocation

According to the Team Manager, the rotation of the staff occurs continuously throughout the day based on the workload. However, the most significant personnel adjustments occur when a new shift begins. At that point, the incoming team can assess how the previous shift performed and if it was on schedule, falling behind, or ahead. This is done through an oral dialogue between the different team managers and by looking in the PMS. This informs the team manager how to reallocate the resources in real-time, if necessary. Moreover, the morning meeting held by the department managers evaluates whether there is a greater need for available personnel in other areas.

As explained in section 4.4, Company Gamma does not employ any hourly workers. This means that the number of staff remains constant from day to day, regardless of fluctuations in workload. When there is less work to do, employees typically spend time cleaning the warehouse. However, the Production Manager explained in the interview that in recent years this has not been a problem, as the company has continued to grow. As a result, the most common challenge is a shortage of personnel rather than having too many, which occurs when personnel are absent or when workload is higher than predicted. In addition, with the existing forecasting tool, explained in Section 4.4.1.1, the company is able to release new lines to pick additional orders if the already suggested are finished. Since these lines are based on forecasts, there is nothing that prevents the system from generating new proposals when needed, which allows for a continuous workflow.

4.4.1.5 Performance Evaluation

According to the Department and Team Manager, there is no formal evaluation process in place to specifically review the planning of the operational workforce.

However, after each workday, the Department and Team Manager engage in informal discussions to reflect on any issues that arose and consider potential adjustments for the current day. Further, they go over the results of the previous day, to assess, e.g., how many orders were picked, or the number of replenishment orders that were completed.

5
Analysis and Results

The following chapter reconnects to the research questions of the master's thesis with the purpose of answering them chronologically with relevant empirical findings and theoretical insights.

The first research question *What process steps should a workforce planning process include?* is answered in Section 5.1. This section brings together the process steps identified in the empirical chapter and connects them with insights from the theoretical framework. The purpose of this section is to clarify the importance of each step in the overall process.

The second research question is *Which data is required to perform the workforce planning process?*. This question is answered in Section 5.2, which builds upon the process steps by analyzing the data required at each stage. Furthermore, it details which type of information is most relevant as input and how it should be applied. This section also presents the output for each step.

Lastly, Section 5.3 answers research question three *How should the workforce planning process be performed?*. This question focuses on how the process steps should be done, who within the organization should be involved, and when each part of the process is best carried out.

5.1 What Process Steps Should a Workforce Planning Process Include?

The workforce planning process steps analyzed in this chapter are based on both empirical findings and theoretical insights. The empirical data identified the specific steps to be examined, while the theoretical framework offered guidance on which steps are of importance. Table 5.1 presents the different process steps, which are used at the case companies. An "x" indicates that the step is applied to some extent, and an "-" shows that it is not used. It is important to note that the same names have been assigned to process steps that serve the same purpose, but can differ in duration and timing. This means that although the steps may vary in terms of duration or the specific time of day they are performed, they are still considered equivalent in function. The focus is therefore placed on the role each step plays in the process, rather than on its exact timing or schedule in each organization.

Table 5.1: *Summary of the process steps used in the Workforce Planning Process in the empirical cases.*

Process steps	Site I	Site II & Site III	Beta	Gamma
Demand Assessment	x	x	x	x
Workforce Allocation	x	x	x	x
Cross-Team Coordination & Adjustments	x	x	x	x
Booking	x	x	x	-
Real-Time Allocation	x	x	x	x
Performance Evaluation	x	-	x	x

5.1.1 Demand Assessment

Demand assessment is a key step for all case companies and is currently integrated into all workforce planning processes examined in the study. As observed in Company Alpha and Company Beta, the demand assessment step is divided into three functions, namely: Inbound, Outbound, and VAS. The empirical findings show that these companies differ from Company Gamma, which only includes Inbound and Outbound functions. This difference comes from the fact that Company Gamma does not operate primarily as a TPL provider. As a result, it does not perform any VAS for TPL customers and operates solely on its own behalf.

Consistently across the case companies, this step is used to estimate the expected workload and define what tasks are to be carried out. This is done using estimated or confirmed data, depending on what is available or considered most reliable for each process in each case. This will be explained in more detail in Chapter 5.2.1. Then, translating these volumes of demand into workforce requirements by calculating how many working hours are needed per process followed by how many employees are needed to cover those hours.

The importance of demand assessment is supported by Bon and Shi Jun (2016) and Slack (2013) in the theoretical framework. Bon and Shi Jun (2016) emphasizes that demand forecasting forms the basis for resource planning, which includes workforce planning. The research also highlights that understanding demand is critical for effective allocation of resources. This means that the ability to translate demand into required capacity is not only a preparatory activity but also an important step within the planning process. Further, Slack (2013) emphasizes the importance of first knowing the demand in order to effectively plan the capacity required to meet it.

5.1.2 Workforce Allocation

In the empirical findings, it was shown that the four case companies have workforce allocation as a process step in workforce planning. For the demand assessed in the previous step to be met, workforce resources are allocated. This allocation is based

on the competence of the employees and the specific requirements of each task within the warehouse, such as the sensitivity to time, the demand, and the physical effort of the activity. Moreover, the empirical findings show that the planners' approach varies between cases. At Company Alpha Site I and Company Beta, a competency matrix is used when assigning personnel to different tasks, allowing planners to assess the level of competency of each employee. However, the competency matrix is not used regularly and is applied mainly during peak periods when there are many temporary workers on site. They also stated, similar to Company Alpha Site II and Site III, and Company Gamma, that they usually rely on their own understanding of their personnel's competence. In addition, compared to the other cases, Company Beta stands out by involving their team leaders in the workforce allocation, as they believe that the team leaders have a better understanding of the personnel due to their close collaboration.

According to Krynke et al. (2019), the tasks of the staff members must be properly organized to make work as efficient as possible. To be effective, the allocation should include aspects such as employee performance, skill level, and relevant experience. This theoretical aspect aligns well with how the case companies have described their approach to workforce allocation, where they expressed that they allocate their personnel depending on their competence. Although empirical findings show that the approach to workforce allocation differs, the outcome appears to give the same result in terms of workforce allocation.

5.1.3 Cross-Team Coordination and Adjustments

Cross-team coordination appeared in all four case companies' workforce planning process, however, for Company Alphas Site II and Site III, the cross-team coordination is carried out in combination with the previous step, Workforce Allocation. The cross-team coordination step is crucial for coordinating between teams within the organization and aligning the individual workforce departments' plans with the overall workforce demand.

According to Stedt (2013), the ability to enable coordination is valuable, as it fosters insight and strengthens a team's ability to better understand their work. The degree to which people engage in meaningful dialogue about tasks and shared goals plays a crucial role in shaping common practices and structures. Coordination allows participants to recognize how their actions or lack of action affect others in their work, which in turn strengthens the team's ability to collaborate and pursue shared objectives.

Following cross-team coordination, adjustments to initial plans must be made accordingly to the new needs, which is supported by all workforce planning processes in the empirical data. This step is considered a sub-step to cross-team coordination and will not be addressed theoretically by the authors. It is viewed as a necessary part of implementation because if adjustments are not made, there is no need for

cross-team coordination.

5.1.4 Booking

In three of the four case companies, booking appears as an additional step in the workforce planning process. This step is specifically relevant when the company relies on external and/or hourly personnel working in the warehouse. It plays a crucial role in these cases as it involves the actual booking of such staff, either through staffing agencies or internal systems. However, this step is not generally applicable in all cases, as its relevance depends on whether the company uses external and/or hourly workers.

The authors have done little to no theoretical research addressing this specific step in the workforce planning process. This is because the step is directly tied to whether a company employs external and/or hourly workers. Based on the empirical findings, the authors concluded that this step is essential in such cases, as without it the company would lack the necessary personnel to carry out any other process steps.

5.1.5 Real-Time Allocation

Real-time allocation is considered a step in the workforce planning process by all case companies in the study. The empirical findings show that this step can be divided into two main situations. The first one occurs at the beginning of the shift, on the day the plan is executed. This moment is crucial as the workforce planning that was made the day before is now being executed and this is also when it becomes clear if something needs to be adjusted to, for example, unexpected absences or how the previous shift performed. As seen at Company Gamma and Beta, these early shift real-time allocations are quite common and often necessary to get the day started properly.

The second situation occurs more dynamically and continuously throughout the day. According to all companies, there are usually several scenarios during a normal shift when plans need to be adjusted based on how operations are progressing. A typical example mentioned by the case companies is that if a staff member finishes a task earlier than expected, the supervisor or team leader must quickly decide how to redistribute this overflow of workforce capacity. This is often done by moving staff to another process, for example, to help with VAS work or to prepare orders for the next day.

However, even if these actions are part of daily operations, the theory points out that real-time allocation can be a sign of insufficiently developed forecasting and scheduling systems (Shandong & Robb, 2019). This theory makes sense in relation to the empirical data, as the more frequent the disruptions occur, the more the organization needs to rely on its ability to act in the moment.

At the same time, this type of flexibility is valuable. It allows the company to adapt and avoid inefficiencies such as staff waiting for tasks or under-staffing one team while another finishes early. Yet, the empirical findings show that while real-time allocation is often treated as a part of the workforce planning process by those involved, the data used in this process step is widely influenced by new data. This subsequently reflects deviations and progress that were not available at the original planning stage.

Therefore, even though real-time allocation is a regular and important part of managing daily operations, the authors argue that it should not necessarily be seen as a planning step. This is because real-time allocation is rather a reactive process on its own, which occurs when there is a misalignment between the planned demand and the actual situation on the execution day and not during the planning process.

5.1.6 Performance Evaluation

The last step identified in the workforce planning process in several case companies is the performance evaluation. According to Khakee (1998), evaluation and planning are two concepts that go hand in hand. When a plan has been created, there should be a follow-up evaluation, which should occur before or after the execution. Although Suzaki (1993) suggests that there should be a proper feedback loop to the input of the system, to view the effectiveness of the process, the empirical findings show that this is usually not the case in practice.

In three of the four case companies, some form of performance evaluation is done after the shift. This typically includes looking at daily KPIs in systems like the PMS and then discussing the results during formal/informal meetings. However, this evaluation focuses on the outcome of operational performance, such as deviations from the expected output. What is missing in all case companies is a more structured evaluation process that reflects on the planning itself, i.e., if the plan that was created actually gave the expected results or not.

Thereby, it can be seen that the companies in this case have implemented a performance evaluation, but primarily as a way to review operational outcomes. As discussed in Section 5.1.5, real-time allocation functions more as a reactive process than as a part of the initial planning step. As a result, when operational results are evaluated after real-time allocation has occurred, what is being assessed is no longer the original plan, but rather the result of adjustments made during execution. Furthermore, the empirical study did not reveal any systematic comparison between the initial plan and the actual outcome, suggesting that no formal evaluation of the plan is performed.

Moreover, this means that the perceived quality of the planning step can be overestimated as supervisors reflect on results that include reactive changes rather than

solely evaluating the effectiveness of the initial workforce plan. As explained by Khakee (1998), the plans made today will have an impact tomorrow. However, if there is no proper feedback loop in place where the planning step itself is evaluated, the planning for the following day is unlikely to improve.

When comparing the empirical findings with the theoretical framework, it becomes clear that there is currently no formal evaluation of the workforce planning process in place. However, the theory highlights the importance of establishing a continuous feedback loop and developing the process over time. As this report focuses on the design of a proposed workforce planning process, the evaluation step is not included within it. Instead, it is considered a separate process on its own. Therefore, it will not be further analyzed in this section. However, it will be addressed in the discussion, Section 6.2, to explore the potential of integrating the planning process into a continuous feedback loop.

5.1.7 The Standardized Workforce Planning Process

This section presents a revised workforce planning process developed from the analysis in Sections 5.1.1 to 5.1.6, based on both empirical findings and theoretical perspectives. The suggested process includes the steps identified as consistently important in all or the majority of the companies studied and is constructed based on observed best practice and theoretical insights. The process steps considered essential are *Demand Assessment, Workforce Allocation, Cross-Team Coordination and Adjustments*, and *Booking*. These steps form the foundation of the standardized workforce planning process and are repeated daily in practice. The process is visualized in Figure 5.1.

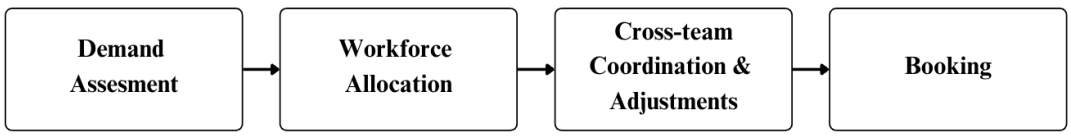

Figure 5.1: *Visualization of the suggested Workforce Planning Process.*

Following the analysis in Section 5.1.5, a decision was made to exclude real-time allocation from the planning process. The reason is that real-time allocation is considered a reactive measure, rather than a proactive planning step. Therefore, the step should not be considered as part of the planning process, but rather as an important function of the *daily operations* in the warehouse, used to handle unforeseen deviations from the original plan. Similarly, the empirical findings of performance evaluation were found to primarily evaluate and reflect the outcome of daily operations rather than actively evaluating the initial workforce plan.

5.2 Which Data Is Required to Perform the Workforce Planning Process?

This section will analyze and answer which data is required to perform the workforce planning process, which aims to answer research question two. This will be done by identifying and analyzing *Input* and *Output* data for each step. This refers to the data or information that is used as input and that is required to perform each step. The output will also be presented, which is, among others, used as input in the next step. In Section 5.2.5, the steps, together with the related inputs and outputs, will be presented for the entire process.

5.2.1 Input and Output Data in Demand Assessment

In the Demand Assessment step, multiple inputs are required for the step to be performed. The most reliable source of input data is confirmed data, which consists of actual placed customer orders, confirmed deliveries, and planned VAS activities. In all cases where confirmed data are available, it is being used. However, in all cases, there are many customers that have cut-off times which are later than when the workforce planning is carried out. Therefore, confirmed data cannot always be used to calculate workforce capacity.

For customers and processes where there are no or only partially confirmed data available, there might be a forecast on which the calculations can be based. However, as seen for all case companies, not all customers provide forecasts. Further, not all forecasts that customers provide are reliable. This make the workforce planning more difficult, as Valashiya and Luke (2023) addresses, accurate forecasts enable better decision making in planning. Moreover, Sanders (2015) explains that planning with inaccurate forecasts will, in this case, lead to a surplus or a shortage of workers, which will drive costs.

For many customers in the warehouse, neither confirmed data nor reliable forecasts are available. In such cases, the empirical study found that the supervisors estimate the demand upcoming themselves. This is typically done using historical order data, where supervisors have collected actual customer order outcomes from previous years to inform their estimations. Chambers et al. (1971), points to the importance of using the right forecasting method for the situation. Therefore, it is important that the supervisors have knowledge of how to shift from different forecasting methods based on, e.g., how much historical data is available and relevant, how precise the forecast needs to be, the time span it should cover, and how much the forecast will benefit the organization.

Furthermore, demand estimations based on planner experience and knowledge are also common in empirical findings. This is supported by Chambers et al. (1971), who argues that when there is a lack of historical data, relying on expertise and knowledge is a good approach. However, solely relying on expertise and knowledge

is dangerous, as it can lead to "black-box management", presented by Suzaki (1993).

In regard to inbound shipments, both smaller deliveries and container shipments, most case companies receive notifications from the customers when these shipments are to arrive. However, in cases where no notification is made, it restricts the ability to plan for the handling of these shipments. Mashiloane and Chinomona (2018) emphasizes the importance of sharing information between partners in the supply chain. Acquiring such information is therefore important to enable demand assessment for inbound shipments.

To translate confirmed data, forecasts, and estimations into the required number of personnel for each process, a standardized calculation is used. This calculation consists of Formula 3.1, which is used to calculate the daily workload, and Formula 3.2, which is subsequently used to calculate the daily required number of personnel for a process. These formulas are used by several supervisors at different cites. It is also supported by Smith (1998), in the theoretical framework Section 3.3. This calculation works using both estimated demand and actual demand as input. However, additional input is required in the form of productivity standards. This will be further discussed in Section 5.3.3.1.

These productivity standards, or goals as they are referred to in the empirical findings, are used by all companies that use the formula to calculate the number of required personnel. However, both Company Alpha Site I and Company Beta indicate that such standards are difficult to obtain for more complex processes. Smith (1998) addresses this issue and argues that identifying standards for all processes can be both time-consuming and costly. However, research shows that investments like these are worthwhile, as they contribute to more effective planning, resource allocation, and operational efficiency. Although determining productivity standards allows better workforce planning, this should not be done as part of the operational workforce planning process, which this study focuses on, as it is an activity that should be carried out as part of the tactical planning NSW Public Service Commission (2019). Thus, these productivity standards are the output of tactical planning, which is then used in this step as input in operational workforce planning.

At Company Alpha Site II and Site III, the empirical study did not find any activity in actually calculating the number of personnel required using these formulas. However, the Warehouse Manager suggests that estimations of required personnel are instead done using experience. In this case, compared to the others, the Warehouse Manager gathers order data in more detail. While other supervisors often only look at the number of orders per customer, the Warehouse Manager at Company Alpha Site II and Site III looks in more depth and investigates the characteristics of the orders. In summary, the input data in the process step Demand Assessment is presented in Figure 5.2.

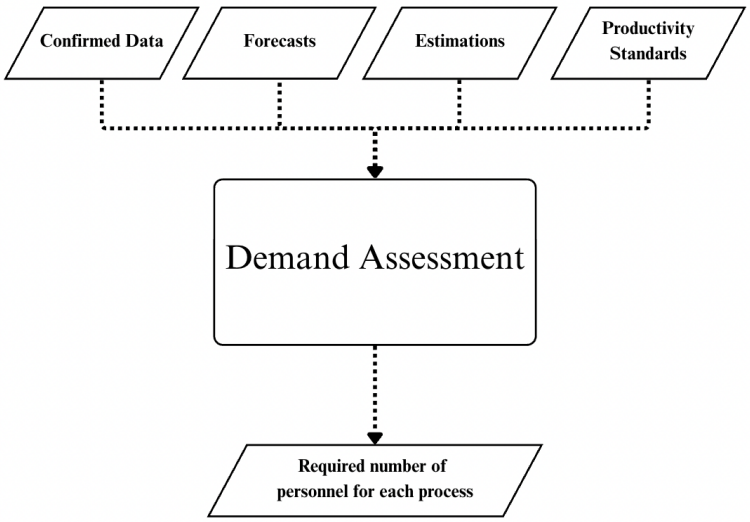

Figure 5.2: *Visualization of the suggested input and output for the Workforce Planning Process step Demand Assessment.*

Using these inputs, the output for this process step, as can be seen in Figure 5.2, is the number of personnel required for each process in the warehouse. This will be used as one of the inputs in the next step of the process.

5.2.2 Input and Output Data in Workforce Allocation

First, the output of the previous step, the number of personnel required in each process, will be used as input in this step. This information is critical to know how many workers are needed per process, or if some workers need to work a few hours in one process and the rest of the shift in another process. However, the step requires further inputs to obtain the desired output.

In all cases in the empirical study, input in this step can be referred to as "knowledge of the employees' competences". This knowledge is tracked in a competency matrix or managed through personal insight from supervisors about who has the competencies for what processes or tasks. Although three out of four cases have a competence matrix, it is not often used in the everyday planning process. Instead, most supervisors rely on their own insight. According to Milewska and Gembalska-Kwiecień (2020), monitoring the competences of the workforce is important as this visualizes potential gaps and allows a more effective allocation of employees.

According to Milewska and Gembalska-Kwiecień (2020), the best way to monitor the employees' competencies is to visualize them in a competency matrix. This provides a structured overview that allows planners to easily compare the competencies of employees with the requirements of each process. By doing so, planners can ensure that the employees assigned to a task possess not only theoretical knowledge but also

practical skills and the right attitude to carry out the work effectively. Moreover, the competency matrix enables planners to balance the workforce across processes when employees have multiple competencies. For example, when the output of the previous step shows that some employees need to divide their time between multiple processes, the competency matrix makes it easier to identify who has the necessary competencies to do so. Planners can also select the best suited employee for each task or plan cross-training to broaden the competence in the workforce.

While the empirical study shows that all supervisors have internal insights into their teams regarding who possesses the competencies for each task, Suzaki (1993) emphasizes the importance of not monopolizing information. Therefore, having a competency matrix as a tool in the company is necessary. Especially in irregular situations, such as when a supervisor is sick and another must temporarily take over the planning, the matrix becomes essential. The matrix should be used actively in the workforce planning process, as it visualizes competencies across the workforce and ensures continuity.

Additional input used in this step includes knowledge of any expected employee absences or availability. Without this information, the planner might assign a specific employee to a process only to later discover that the employee is unavailable.

Another input identified in the empirical study is a prioritization list, where processes are ranked by importance. This list is used in cases where the workforce is treated as a fixed resource and cannot be adjusted in response to demand. This approach is mainly applicable in Company Alpha Site II and Site III and Company Gamma, since these case companies do not change their staffing levels day by day. Company Alpha Site II and Site III could have a dynamic workforce with the use of the staffing agencies that they currently use, however, the management of the sites has set a strategy to keep the workforce fixed. In the other case companies, where staffing levels have the possibility of fluctuating, the relevance of strict prioritization lists decreases. In the proposed standardized process, a prioritization list will not be included as input in this step, as it is not applicable in dynamic workforce environments.

The input and output data for the workforce allocation step are summarized in Figure 5.3. The output of this step in all case companies is an operational workforce allocation plan for each supervisor. This is also the outcome of the process step suggested in this study. This plan specifies the distribution of personnel across processes and shifts, ensuring that the demand identified in the previous step is met effectively. This output is also used as input in the next step of the process.

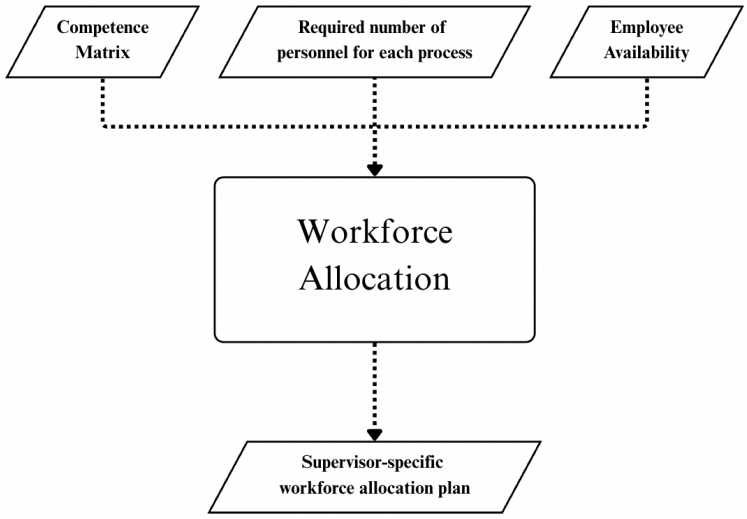

Figure 5.3: *Visualization of the suggested input and output for the Workforce Planning Process step Workforce Allocation.*

5.2.3 Input and Output Data in Cross-Team Coordination and Adjustments

The primary input to this step is the workforce allocation plan created by each supervisor in the previous step. These plans specify how many employees are assigned to each process and which workers are allocated to each task for the upcoming shift or day. During this step, supervisors are to compare plans to identify whether there are any imbalances, such as surplus staff in one team and shortages in another. Therefore, the workforce allocation plan is the essential input in this step, as it provides the basis for detecting whether a personnel reallocation is necessary.

Moreover, the competency matrix is also a valuable input. The same arguments as in Section 5.2.2 can be made in this step. When the comparison in this step results in a surplus of staff in one team and a shortage in another, reallocation can only be done if the workers have the required competences to work in the receiving team. This should be monitored in a competency matrix. Further, if the teams are to "share" an employee, that employee needs to possess the right competencies, which will be covered in the competency matrix.

The inputs for Cross-team Coordination and Adjustments are visualized in Figure 5.4, together with the output of the process step. The output of this process step is an adjusted workforce plan that meets the total demand for the warehouse. This plan is then used in the next step as input to schedule the employees involved.

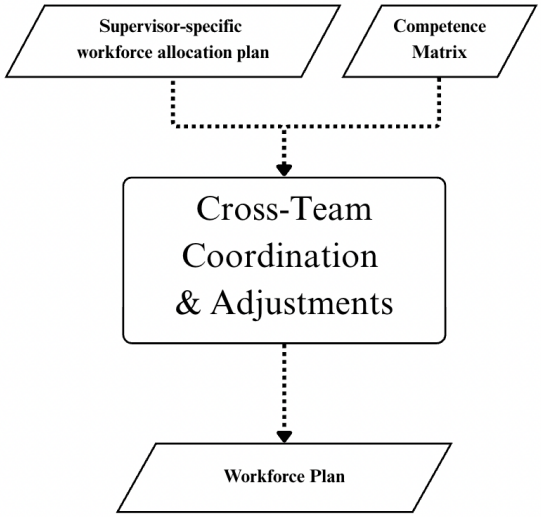

Figure 5.4: *Visualization of the suggested input and output for the Workforce Planning Process step Cross-team Coordination and Adjustments.*

5.2.4 Input and Output Data in Booking

The empirical study shows that the booking step is purely administrative and is entirely based on the output of the previous step. The only input required is the coordinated workforce plan, which specifies how many external or hourly staff need to be booked and for which processes. The output will be the confirmed workforce plan. The input and output data for this step are visualized in Figure 5.5.

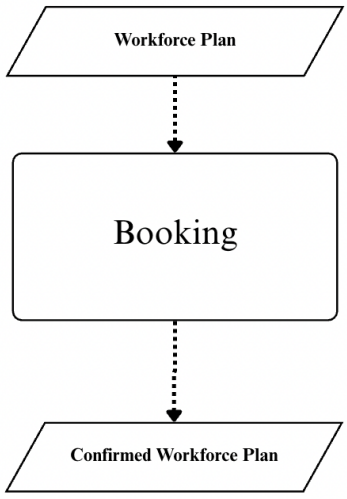

Figure 5.5: *Visualization of the suggested input and output for the Workforce Planning Process step Booking.*

5.2.5 Workforce Planning Process

Figure 5.6 presents the complete workforce planning process with inputs and outputs for each step.

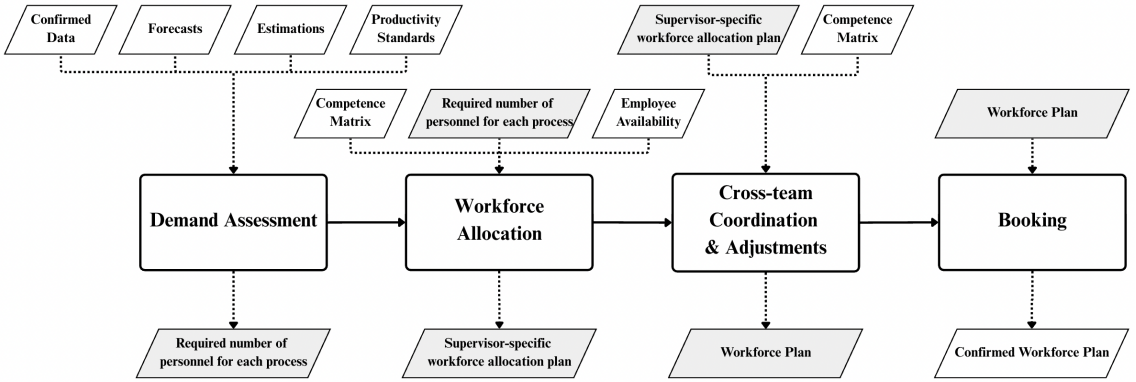

Figure 5.6: *Visualization of the suggested input and output for each step in the Workforce Planning Process. The output for each step is used as input in the next step, visualized by the gray parallelograms.*

5.3 How Should the Workforce Planning Process Be Performed?

This section aims to analyze and answer research question three. The section is divided into three smaller questions, since the third research question is divided into the perspectives *When?, Who?* and *How?*. First, in Section 5.3.1, the question of *When?* will be analyzed. Second, the matter of *Who?* will be analyzed. Finally, the question of *How?* will be presented and analyzed. This section will be divided into a more detailed analysis, with each step of the proposed workforce planning process.

5.3.1 Workforce Planning Time Frame

The timing of the operational workforce planning process is a crucial factor in ensuring that the efficiency and service levels are met. From the empirical findings, it can be seen that all case companies typically perform some parts of their workforce planning one day before the execution day. All companies plan the three core warehouse functions: inbound, outbound, and VAS at the same time.

Achieving high service levels requires maintaining short LT. In practice, this is achieved by allowing late cut-off times for customer orders, followed by prompt outbound processing. For example, Company Alpha Site I frequently handles customer orders with cut-off times as late as the day of execution, which emphasizes the importance of planning in a way that accounts for these limitations. Furthermore, e-commerce, which is a segment that exists in all companies, is particularly sensitive

to LT. As noted in Gawor and Hoberg (2019), customers have the ability to order items from anywhere at any time, providing greater flexibility in the ordering process. However, this flexibility for the customer imposes constraints on the company, as confirmed order data may arrive as late as the day of execution.

The possibility of executing workforce planning the day before execution day is also tied to predictability and control over inbound deliveries. At Company Alpha, inbound flows are determined by TPL customer requirements, reflecting the company's function as a TPL provider. Deliveries may occur at different times each week depending on restocking needs, which vary both by TPL customer and season. Although some shipments arrive steadily in smaller batches, others are large containers. Nevertheless, the actual arrival times are usually communicated through inbound logs on relatively short notice. This uncertainty limits the possibility of finalizing workforce allocations well in advance.

In contrast, Company Beta benefits from inbound deliveries that are scheduled well in advance. This facilitates better long-term planning for the allocation of employees in the inbound function. Company Gamma, which is not primarily a TPL provider and instead manages its own goods, has a higher degree of control over inbound shipments. This allows the company to finalize its workforce planning earlier than in the other cases, as its logistics operations are not dependent on third-party customer schedules. Consequently, planning further in advance is possible without compromising accuracy.

The empirical findings also reveal that VAS, in some cases, is an integrated part of operations at Company Alpha and Beta and does not exert the same pressure on workforce planning as inbound and outbound functions. Some VAS activities require additional workload outside the process in which they are sometimes integrated, which requires additional planning. However, since VAS activities are usually not given by the TPL customers as late as one day in advance, this function has the possibility of being planned earlier than one day before the execution day.

In contrast, the outbound function is consistently described as the most critical component of daily operations according to all case companies. Ensuring that enough personnel are allocated to outbound activities is essential to maintain high service levels. As Abrahamsson and Wandel (1998) explains, the traditional organization of a logistic link with TPL providers is usually divided in a way in which the company still manages and controls the flow of the goods, while the outsourced part is only the execution itself. The lack of control over external timelines, such as cut-off times and LT, underscores the importance of internal flexibility and responsiveness to a changed demand on short notice.

Given the limited availability and often questionable reliability of the forecast data, the authors of this study argue that conducting workforce planning one day before execution is a necessary response to uncertainty. Several supervisors in the case companies indicated that the forecast data is supplemented with professional judgment

based on recent trends, which often generates more accurate results than relying solely on forecasts provided by the customers. This aligns with Sanders (2015), who states that short-term forecasts are typically more reliable than long-term forecasts. Therefore, performing workforce planning as close to execution as possible increases the likelihood of working with confirmed and accurate data, as the supervisor is able to create its own forecast from recent demand and not solely look at the long-term forecasts given by the customer.

While it was found that the planning for the inbound flow could be done earlier than the day before the execution day, the authors of this study suggest that all planning is done simultaneously. Hence, the most critical part of the planning, the outbound function that directly impacts service levels, should determine the planning time frame. Thereby, with theoretical insights and empirical findings in mind, performing workforce planning one day before execution is the most effective way. This ensures that the most accurate and recent data act as input data for resource allocation in TPL operations. This timing enables the integration of recent demand trends and improves responsiveness to last-minute changes while still maintaining the necessary service levels.

Performing the workforce planning process one day before execution is therefore the most effective approach in TPL operations, as it allows companies to base staffing decisions on accurate and updated information that reflects recent demand trends, particularly in the outbound function. Although some functions such as inbound and VAS could be planned earlier, the planning process is intended to be done simultaneously and, therefore, guided by the most critical function. Since this timing requires short-term responsiveness, the workforce must be flexible. Therefore, as found in both empirical and theoretical studies, companies need to rely on external or hourly workers who can be scheduled with short notice, unlike other employment types such as part-time, to meet the fluctuating daily operational needs and maintain the required service levels.

5.3.2 Roles Involved in Workforce Planning

In line with NSW Public Service Commission (2019), operational workforce planning should be led by supervisors, while tactical workforce planning should be led by senior leaders and other important decision makers. This statement is also found in the research of Smith (1998), in which it states that the supervisors within the organization are responsible for the planning of the short- and long-term workforce. The empirical findings show that this is usually the situation, except at Company Alpha Sites II and Site III, where the warehouse manager also manages the operational workforce planning.

It was also concluded from the empirical data that the team leaders, who are in the role "below" supervisors, have some sort of impact on the workforce planning. In some cases, the supervisor collaborates with the team leaders to make adjustments

in real-time. However, as the real-time allocation is determined to be outside the new workforce planning process, this collaboration will not be discussed in this report. In Company Beta, supervisors were discovered to work in close collaboration with team leaders in the majority of the workforce planning process. However, they are primarily involved in terms of staff allocation. This means that team leaders are involved both in the allocation of tasks and in deciding which staff from the hourly workforce should be booked for the upcoming day.

Suzaki (1993) highlights the importance of involving more people in decisions within an organization, described as not separating those who think and those who do the manual work. By including team leaders in operational workforce planning, Company Beta reduces the risk of "black box management", where only one person holds all the knowledge. This approach allows team leaders to share insight from the shop floor with supervisors, while supervisors can inform team leaders about the upcoming demand. As a result, both parties contribute their expertise, fostering discussions that consider multiple perspectives to determine best practices. In line with this, the suggestion is to encourage team leader participation to the appropriate extent within the workforce planning process. Including team leaders should be done in steps, such as workforce allocation, where their skills and knowledge can contribute with meaningful insights. Moreover, when more employees gain relevant skills, the organization builds a broader knowledge base. This allows manual workers to potentially organize their own work areas and manage themselves to some extent, an outcome consistent with the principles outlined by Suzaki (1993).

5.3.3 How the Operational Workforce Planning Process Should Be Performed

This section will include an analysis of *how* the different steps in the workforce planning process should be done.

5.3.3.1 How to Conduct Demand Assessment

To carry out the demand assessment step, the planner should start by reviewing the available input data, such as confirmed volumes, forecasts, and estimations. This should be done separately for each process and customer, but combined when several customers share the same operational processes. The demand should be divided in the same way as how the processes are divided for the productivity standards, since the demand is divided by the productivity standard in Formula 5.1, previously presented as Formula 3.1. Thereafter, calculating Formula 5.2, previously presented as Formula 3.2, in line with Smith (1998). This is also supported by the empirical findings, as supervisors have presented the same formulas for their calculations. To make this step easier and decrease manual work, one recommendation is to use an Excel formula or a similar tool.

$$\text{Daily Workload} = \frac{\text{Estimated Demand}}{\text{Benchmark Productivity}} \tag{5.1}$$

$$\text{Required number of personnel} = \frac{\text{Daily Workload}}{\text{Time/Daily/Employee}} \tag{5.2}$$

These calculations should be repeated for each process and the result should be documented and passed on to the next planning step. While the data used may vary in quality, from confirmed to estimated, the method of translating demand into required workforce remains the same.

5.3.3.2 How to Conduct Workforce Allocation

The empirical study found that the main activity during the workforce allocation phase in all cases was assigning staff to the various processes and tasks that needed to be completed. Some cases carry out this allocation at the individual level, while others divide their workforce into different teams.

Company Beta and Gamma perform workforce allocation at an individual level, incorporating purposeful staff rotation. Particularly, at Company Beta, for their hourly workers, who require rotation to maintain their competencies. This approach is supported by Hochdörffer et al. (2018), who emphasizes the importance of rotation in the workplace to keep knowledge and skills fresh across different tasks. However, constant rotation across multiple tasks and processes may result in a lack of deep expertise. Therefore, in a TPL environment, with multiple unique customers, the ideal approach is not to rotate all staff across all processes, but rather to limit rotation to selected tasks where it provides the most benefit.

To enable rotation, the workforce must be cross-trained. This is supported by Vasanthi and Basariya (2018), who argue that a lack of cross-training can lead to monotony and boredom among employees. Furthermore, a cross-trained workforce enhances flexibility, as employees can shift between roles or processes based on operational needs. As found in the empirical findings, several cases have a cross-trained workforce where employees can switch from one process to another. However, not all work with purposeful rotation and instead only rotate personnel when they are understaffed.

The purposeful rotation between tasks and processes is suggested to be implemented in the workforce planning process and to be done in this step. Therefore, the workforce allocation should be done at an individual level. The supervisors can do this using the competency matrix as a support.

5.3.3.3 How to Conduct Cross-Team Coordination and Adjustments

The empirical study found that cross-team coordination takes place in both formal and informal settings. At Company Alpha Site I, a formal meeting is held between the supervisors and Site Manager I to discuss individual workforce plans and to make the necessary adjustments to meet overall demand. Holding a formal meeting each day also facilitates cross-training and rotation between supervisor teams. By intentionally planning such activities, the organization ensures that staff with the necessary competencies are available when a particular supervisor team requires specific skills.

This aligns well with research, which shows that coordination between teams can provide broader understanding and strengthen the ability to collaborate and pursue goals (Stedt, 2013). In addition, successful teamwork requires regular meetings. Through these meetings, participants can create space to discuss ideas, make decisions, and improve processes (Kauffeld & Lehmann-Willenbrock, 2012). Furthermore, meetings that focus on knowledge sharing and problem solving are positively associated with successful team outcomes.

5.3.3.4 How to Conduct Booking

The booking step should be done by informing external or hourly workers through the appropriate communication channels. In cases involving external personnel, the staffing agency should be provided with a list of the requested staff.

6
Discussion

The purpose of this chapter is to discuss topics worth considering that have not been touched upon earlier in the report. This includes the applicability of the workforce planning process in different scenarios and if it is possible to implement a feedback loop to enable continuous improvement. Moreover, this chapter will include a discussion of method, the gap in the theoretical literature, the sustainability perspective, and further recommendations.

6.1 Applicability of Findings

Given the operational complexity of the case companies, the proposed workforce planning process should be seen as a flexible framework rather than a fixed model. This study has identified four main process steps: Demand Assessment, Workforce Allocation, Cross-Team Coordination and Adjustments, and Booking, which can be considered relevant steps for TPL warehousing companies. The way in which they are applied must be adapted to each case based on specific customer behavior, available staffing structures, and whether it should be used during peak season or not.

6.1.1 How Does the Workforce Planning Process Stand in Relation to a Static- or Dynamic Workforce?

One aspects that limit the applicability of the proposed workforce planning is the dependence on external- and/ or hourly personnel. Both empirical and theoretical findings show that using staffing agencies or having parts of the workforce working hourly can offer flexibility. The use of staffing agencies has also been found to introduce uncertainty. As seen at Company Alpha Sites II and Site III, there is a dependency on the competence of external personnel. This leads to hesitation about not scheduling them every day of the week, as there is a concern that they may become dissatisfied and eventually leave, resulting in a loss of valuable expertise.

This fear creates uncertainty in workforce planning, leading to the planned capacity not aligning with actual demand. The reluctance to allow a dynamic workforce capacity will lead to reduced flexibility and increased costs. Therefore, the proposed planning process will not gain its full potential. Thus, the findings of this study are primarily applicable to TPL warehouse environments that deal with daily demand fluctuations and rely on a mix of internal, external, and/or hourly employees.

6.1.2 How Does the Workforce Planning Process Stand Against Peak Seasons?

In addition to general workforce planning, specific considerations must be made during periods of peak demand. As demonstrated in the empirical findings, all cases with evident increased demand during periods of time, begin planning for these peak seasons well in advance. For example, Company Gamma initiates the recruitment of personnel as early as January in preparation for a gradual increase in activity throughout spring, reaching its highest point in the summer. They also plan for summer workers during spring to ensure that they have time to train the new personnel before the peak season begins.

This type of planning is tactical rather than operational, as it focuses on a longer time horizon, often several months ahead, rather than on daily activities. It requires future demand and developed strategies for training and personnel management to ensure readiness. Company Gamma experiences two distinct peak seasons, one during summer and another during Black Week. Their approach to Black Week involves contacting former summer workers to assess their availability and interest in returning. This strategy stems from their decision not to use staffing agencies, which has both advantages and disadvantages. One advantage is that summer workers are often students who may also be available during Black Week. In addition, since they are already familiar with the company's processes, minimal training is required, allowing them to start immediately. However, a disadvantage is the uncertainty of their availability, for example, if a significant number of students decline to return, the company must rely solely on its permanent staff.

In contrast, Company Alpha and Company Beta utilize staffing agencies and hourly workers to manage workforce demands during peak seasons. The staffing agencies have broader networks and can more easily provide temporary staff. However, this approach may compromise the quality of training and onboarding. External temporary personnel from staffing agencies may lack prior experience in the company, requiring basic training, and limiting opportunities for cross-training or rotation among permanent staff. For example, if temporary workers are only employed during the peak season, the company may not have the opportunity, time, or resources to train them in all processes. Consequently, regular employees may need to take on more complex tasks, while agency workers are assigned simpler processes, potentially disrupting the skill development of permanent staff.

The operational workforce planning process proposed in this study is designed primarily for standard conditions. However, it can be applied during peak season as well. It may not be appropriate to implement the process to the same extent as under normal conditions, but that does not mean that it cannot be implemented at all. For example, cross-training temporary employees to allow rotation, as described in the proposed model, may not be practical during peak seasons. Given that cross-training increases costs, companies may be unwilling to take that expense if temporary personnel are only employed for a short period. However, this does

not mean that the workforce allocation step is no longer functional, but that it may become more complex due to the lower competence among the employees.

The standardized workforce planning process is, as stated, an operational process, which is applicable during peak seasons. However, preparations in the form of tactical planning must be done in advance, to enable the process to work. Further, some steps in the process might not be done to the same extent as in normal conditions.

6.2 Is it Possible to Implement a Feedback Loop?

The analysis in Sections 5.1.5 and 5.1.6 showed that the case companies evaluate their workforce planning process to some extent or not at all. As it is now, they might look at how well the outcome, suggested by the KPIs, came to be after the execution. However, they do not really evaluate the planning process itself. Because of this, the discussion in this subchapter will go through a possible evaluation component that could help make use of feedback in a more structured and systematic way.

The purpose of an evaluation step is to compare the original plan with the actual result to highlight discrepancies that require attention. The purpose of this evaluation is not only to observe what went wrong, but to use the insights gathered to enhance the quality of future plans. This aims to change the planning process from a reactive one, through daily operations to continuously improving through evaluation. The structure of this evaluation component reflects the methodology of PDCA (Plan-Do-Check-Act) explained by Sokovic et al. (2010). In this structure, the authors of the thesis suggest that the workforce planning process is incorporated into the PDCA according to 6.1.

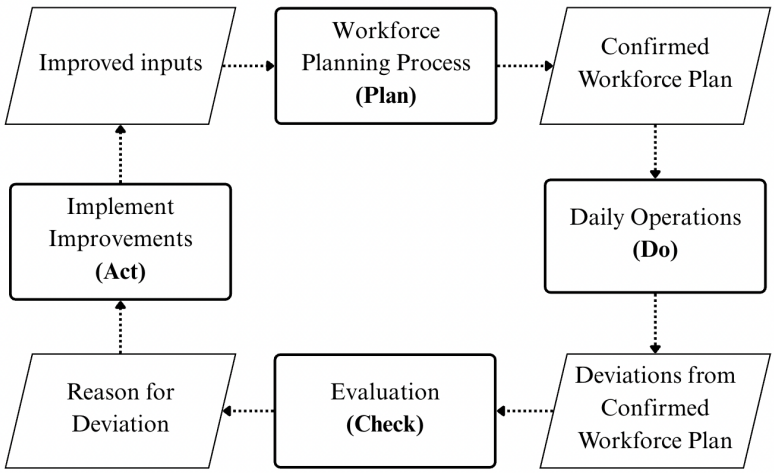

Figure 6.1: *Visualization of the PDCA feedback loop including input- and output data.*

The authors of the study suggest that the workforce planning process represents the "Plan" phase, while the daily operations correspond to the "Do" phase. During daily

operations, unexpected deviations may occur, which are handled through real-time allocation. In the "Check" phase, the evaluation takes place by comparing the actual results with the original plan. This step is critical within the PDCA as it identifies whether the decisions made and the inputs in the planning phase were good enough. Finally, in the "Act" phase, the insights gained from the evaluation are applied to revise and refine the next possible planning cycle.

Through the PDCA-based feedback loop, the workforce planning process will open up for continuous improvement after every cycle. Although daily operations remain outside of the suggested planning steps, the data it produces feeds directly into the evaluation phase, supporting more informed and responsive planning. When the evaluation component is included as a supplement to the proposed workforce planning process, it ensures that the workforce planning cycle can be systematically controlled and measurable, which reflects the established principles of process management presented by Suzaki (1993).

Operational workforce planning also requires close monitoring of resource needs, making sure that unexpected changes are handled promptly (NSW Public Service Commission, 2019). This fits well with the analysis in Section 5.3.1, which showed that the most optimal time for workforce planning is the day before the execution day. This time frame is in line with the PDCA cycle, as the discrepancies between the plan and the results after the execution day need to be taken into account in the next possible cycle. For example, if yesterday's execution revealed discrepancies compared to the plan, these can be analyzed, addressed, and formed into actions today. Preferably, this is done before today's planning process, which enables today's planning to be improved.

The PDCA should acknowledge all discrepancies that occur during the execution in comparison to the plan, these deviations can arise from different causes during the execution day. Deviations in demand often result from inaccurate forecasts or estimates. This can be found by comparing these with the actual outcome to identify areas for improvement in the PDCA cycle. Undercapacity, shown through overtime or unfinished tasks, requires a deeper analysis to find the root cause, as it may not directly relate to the process in which it appears. Overcapacity can be spotted through, e.g., early leave or low productivity. However, productivity must be compared to reliable productivity standards.

To ensure accurate evaluation, all frequent tasks should have clear productivity standards that must be revised if consistent deviations occur. Identifying root causes of deviations is key for supervisors using the PDCA cycle, as it supports effective actions. This should be done together with team leaders, whose operational insight is essential.

Based on the findings of the evaluation, improvements should be implemented to strengthen future planning. Simpler improvements, such as adjusting estimations, should be made immediately to ensure better accuracy in the next day's planning.

More complex improvements, such as updating productivity standards or initiating structural changes, may take longer and require coordination with team leaders or other departments. However, these improvements are important as they will lead to an improved planning process.

6.3 Method Discussion

It was believed that if more companies had participated in the study, the empirical data would have been more generalizable due to a larger data set. With broader participation, the authors could have examined the differences between TPL providers and companies that managed their own logistics, offering a clearer picture of these distinctions. Additionally, including more companies would have allowed a comparison between larger and smaller firms to explore whether they operated differently.

If the study had spanned a longer period, it would have been possible to examine Company Gamma more thoroughly. Company Gamma is a large organization with several departments and it would have been interesting to explore in more detail why their workforce planning process differed from that of TPL warehouses. In particular, Company Gamma is the only company that does not use staffing agencies or employ hourly workers, yet still manages to handle its logistics effectively. Since Gamma follows a different approach to staffing, this would have been worth investigating more thoroughly. With more time, the authors of the study could have conducted more interviews with team and department managers to better understand how the planning process is done in different parts of the company and whether their ways of working vary depending on the department. Furthermore, the extended timeframe would have allowed for a more detailed analysis of the data to assess the impact of owning the entire logistics flow, in contrast to Company Alpha and Beta, which only managed warehouse execution as TPL providers.

Furthermore, if there had been more time, the authors would have liked to have a workshop where the different supervisors could have contributed their thoughts on the empirical findings and theoretical insights. This would have enabled discussions on which way of working was better or more effective than another. Such a workshop would have provided an opportunity for open dialogue between practitioners, allowing the authors to explore the reasoning behind different workforce planning strategies. Together, they could have gone through the various steps involved in each company's planning process, compared methods, and identified potential strengths or weaknesses. This exchange would not only have deepened the authors' understanding, but would also have strengthened the reliability of the findings by incorporating expert opinions. In addition, the supervisors could have shared which approaches they believed had worked better or worse in practice, whether they had tested them before, and what the results were. Their experience would have added reliability to the study and helped bridge the gap between theory and practice.

6.4 Lack of Information in Theory

Throughout the research process, it became evident that there is a gap in theoretical literature that addresses operational workforce planning processes, especially in TPL warehousing. Although there is research on strategic and tactical workforce planning, theory on short-term planning, such as daily allocation and daily operations, is limited. These limitations made it, at times, hard to link empirical findings from case companies with established research.

In some cases, it was challenging to find a relevant theory focused specifically on the workforce planning process in a warehouse. In those situations, literature from other sectors, such as production and retail, was used. These sources were considered relevant to the problem in the TPL warehouses, although they were from different sectors, as they experienced similar problems in their workforce planning as those challenges seen in the empirical findings.

The gap between theory and practice shows that more research is needed on operational workforce planning processes. This applies both within TPL warehouses and in other sectors. The need is especially strong in environments where companies rely heavily on reactive measures to meet performance targets instead of planning for them.

6.5 Sustainability

This thesis does not explicitly focus on sustainability or the triple bottom line, yet its findings could be of indirect relevance to social and economic sustainability dimensions.

From a social perspective, the participation of team leaders in operational workforce planning can reduce the gap between supervisor and shop floor staff, which can increase motivation among employees. This decentralization also allows self-management among employees due to increased knowledge sharing and participation. In addition, since supervisors and team leaders work in collaboration, it improves employee satisfaction as more people have the opportunity to gain skills. Furthermore, cross-team coordination is an effective way to foster insight and strengthen supervisors' positive feelings toward each other. Since cross-team coordination can make supervisors feel like they are part of the same team, striving for a common goal.

Economically, the ability to carry out workforce planning one day before execution and have cross-team collaboration allows for a higher ability to have more accurate and recent data, which decreases the risk of unnecessary labor costs while still maintaining service levels. In addition, the use of hourly workers and cross-trained personnel contributes to flexibility with a reduced risk of overstaffing. Furthermore, the implementation of continuous rotation among staff will strengthen the ability to know that personnel remember how to do their tasks efficiently and at the same

time increase satisfaction by decreasing monotony.

6.6 Further Recommendations

To further build on the findings, several potential areas could be explored. Future research could focus on how the proposed workforce planning process can be implemented in practice. While the suggested process is more or less similar to the processes studied in this research, the process provides a structured framework tailored to TPL operations. However, its applicability and effectiveness in practical settings were not tested in this study.

Another suggestion is to explore the importance of tactical and strategic planning in TPL warehousing. As this study only focus on operational workforce planning, the tactical and strategic aspects remain underexplored. Future research could therefore investigate how medium- and long-term planning decisions impact operational efficiency and flexibility in TPL settings. In addition, studying the alignment between strategic, tactical, and operational planning could provide valuable insights into how companies manage uncertainty and demand variability over time.

Furthermore, the empirical findings revealed a limited formal evaluation of workforce planning activities. Further research could examine the practical potential of a structured feedback loop in workforce planning. A suggestion of a feedback loop is presented in Section 6.2, however, further study of this suggestion could be made. Future studies could asses how implementation of a PDCA affects workforce adaptability, decision quality, and long-term performance.

Although certain elements related to workforce satisfaction were mentioned, such as job rotation to decrease monotony and opportunities for skill development, these aspects were not examined in depth. There is therefore potential for further research. It could systematically investigate the actual impact of such practices on employee satisfaction and engagement. This is particularly relevant where initiatives like cross-training and rotation are implemented. Exploring how these practices influence motivation, retention, and perceived fairness among employees could offer valuable insight.

7
Conclusion

The purpose of this chapter is to present the general conclusions of the thesis. These conclusions are based on the aim, the research questions, and the answers provided throughout the study.

The aim of the master's thesis was to develop a standardized operational workforce planning process tailored to TPL warehousing. The focus of the study has been on the planning of warehouse floor personnel and has been achieved through a multiple case study. In this study, there have been three different case companies that have provided four different cases. In addition, the method for collecting empirical data has been through interviews and company visits.

What process steps should a workforce planning process include?
The cross-case analysis performed from the four cases, together with theoretical insights, provided four process steps in a standardized operational workforce planning process. These different process steps are: *Demand Assessment, Workforce Allocation, Cross-Team Coordination,* and *Booking*. Detailed explanations of each of the steps is presented in Section 5.1.

Which data is required to perform the workforce planning process?
For each of the identified process steps, specific input and output data are required. The input data for each step of the process can be found in Section 5.2, where the output for each step of the process is part of the input for the next step.

How should the workforce planning process be performed?
The third research question is divided into three different aspects *When?, Who?* and *How?*. The question *When?* aims to answer when the workforce planning process should be carried out. The aspect *Who?* answers the question of which employees should carry out the different tasks of the process steps and *How?* refers to how it should be carried out. This study has established that the process should be carried out one day before the execution day, to ensure that as much relevant data as possible is available in time, while also having time to book or cancel personnel for the upcoming day's execution. The employees responsible for carrying out the planning are the supervisors, with the help of the team leaders. The procedure of how the workforce planning process should be carried out is explained in detail, together with the other aspects, in Section 5.3.

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A

Appendix A

The interviews in this study were conducted in Swedish. The interview questions have been translated into English for the purpose of this thesis. Below are the two sets of translated interview questions: A1 used in interviews with site managers or equivalent roles, and A2 used in interviews with supervisors or similar positions.

Appendix A1: Interview Questions - Site Managers

Introductory Questions

- Could you briefly describe who you are and your role?
- What are your main tasks and responsibilities?

Staffing

- How many people work at the site?
- How does this vary throughout the year, depending on seasonality and order volume?
- How many of these are internal employees vs. agency workers/part-time employees?
- Why do you use agency workers or part-time staff?
  - *If not, why not?*

Planning Process

- What responsibilities do you have when it comes to workforce planning?
- What are the biggest challenges you see in workforce planning within your operations?
- Which roles are involved in workforce planning, and what is each role responsible for? (what steps are included)
- How do the involved people know how to carry out the workforce planning? Are there any process standards or guidelines?
- How often is the planning performed, and for what time frame?
- Is any type of IT system used for planning?

Data

- What data is used when you do workforce planning?
- Who is responsible for gathering this data?
- In what way is this data used?
- Is the data used for decision-making considered reliable?

Evaluation and Development

- How do you evaluate whether the workforce planning process is working well?

- Is it measured through any KPIs or follow-up methods?
- Have you made any major changes to the workforce planning process in recent years?
  – *What was the reason for these changes, and what have been the effects?*
- Is there anything you would like to improve or further develop in the workforce planning process? If so, what?

Appendix A2: Interview Questions - Supervisors

General Questions

- Could you describe your role as an Operations Manager?
- Which customers are you responsible for, and how would you categorize them? (e.g., E-commerce, Retail, Industrial Supply, etc.)
- What responsibilities do you have when it comes to operational workforce planning?

Staff

- How many employees work in your team?
- Do you have any team leaders? If so, how many?
- If applicable, are the team leaders responsible per customer or per process?
- How does the staffing need vary throughout the year, depending on seasonality and order volume?

How and What

- If you see workforce planning as a process with different steps, what steps would be included?
- Are others involved in workforce planning? If so, which roles are involved and what are they responsible for?
- Do you collaborate with the other supervisors?
- How often is the planning carried out, and for what time frame?

Data

- What data do you use when doing workforce planning?
- Who is responsible for gathering this data?
- In what way is this data used?
- Do you consider the data used for decision-making to be reliable?

Competences

- Are employees trained in multiple processes?
- Do you actively work with training your current staff?
- How do you work with employee rotation?
- Do employees also rotate between supervisor teams?
- How do you keep track of what competences each employee has?
- If a competence matrix is mentioned: Is the matrix used in the planning process?

Evaluation

- How do you handle sick leave?
- Do you call in extra staff when you are notified of absences?
- Do you evaluate whether your workforce planning is effective?
- Is the planning measured through any KPIs or follow-up methods?

- Do you often find that you are overstaffed?

Closing Questions

- Have you made any changes to workforce planning in recent years?
  – *If yes: What was the reason for these changes, and what has the effect been?*
- What do you consider to be the biggest challenges in workforce planning in your team?
- Is there anything you would like to improve or develop in workforce planning? If so, what?

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS
DIVISION OF SUPPLY AND OPERATIONS MANAGEMENT
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden
www.chalmers.se

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