Coolblue - Optimization of Parcel Processes

Project Vision and Scope TIL5050

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1 Introduction

1.1 Company problem

Coolblue is a Dutch online retailer of electronics with a focus on high service. The high level of service is achieved by next day delivery, free shipping and an excellent customer service. The company has experienced major growth in the last few years due to the growing market of on-line retail in general, and gaining a larger market share. This massive growth causes ever changing conditions in which Coolblue has to operate, while maintaining their level of service.

Last year, the company has opened their newest distribution centre (DC) in Tilburg. After a transition period of approximately one year their old DC in Capelle aan den Ijsel has been closed at the begin of February 2018. Now, all distribution operations for the BENELUX area are performed from the DC in Tilburg. To cope with the increasing throughput in the DC in Tilburg, the logistical engineers were busy solving problems all around the DC to ensure the service level was met last year. Going forward, the company wants to explore the opportunities of changing, mechanizing or robotizing key processes to reduce cost of labour and to cope with the future increases in throughput with the limited surface area available in the DC.

1.2 Scope

For this design project, research is done at the DC of Coolblue to find certain processes that could be made more efficient in both time and cost. This kind of research is also know as supply chain optimization. Supply chain optimization is an logistical topic and therefore the subject of this project is within the scope of the study Transport, Infrastructure and Logistics.

The project itself is scoped only on the parcel processes within the DC and therefore doesn't consider the two other streams of goods, namely XL-packages and "Witgoed". A broader explanation of the project is given in the following chapters. The design options that are proposed in this study have a scope of 1 year in terms of implementation time.

1.3 Practice and Science

Coolblue is a market leader in the Dutch e-commerce industry, and is experiencing outstanding growth annually (and is expected to keep doing so). Although, the market share and revenue are increasing annually, the company is mainly focusing on meeting their orders and deliver them next day. Optimization of their processes, and finally decreasing the costs per package is hard due to continuously changing conditions and an increasing demand curve. Beside Coolblue more companies are experiencing this situation, for example Tony Chocolonely, Rituals and Action. Therefore, the question arises how to optimize supply chain processes in such a highly dynamic environment. This report aims to develop a improvement framework that identifies inefficiencies and waste, which of these processes are most critical, come up with solutions to redesign these processes and what the impact on the costs per package is of the implementation of the redesigns. Coolblue will be used as a case study to test the developed framework.

2 Current State Analysis

In this chapter the objectives and the research question are presented. Afterwards, the problem is discussed in more detail and the current state of the process is described, using a function method. Finally, a context and stakeholder analysis are given.

2.1 Research Question

Coolblue is a fast growing e-commerce in the Netherlands. Over the past 20 years Coolblue's main goal was to grow and to extend the business by delivering perfect customer care. However, nowadays their desire is to focus more on reducing the company's operational costs and improving the efficiency in the warehouse, while keeping in mind their excellent customer service. Therefore the following research question is defined:

"How can the costs per parcel be minimized focusing on the in- and outbound processes of Coolblue's warehouse while ensuring high level of service in a fast growing environment?"

In order to answer the research question appropriately different sub question have been defined.

1. **What is the current state of the in- and outbound parcel process in the warehouse in Tilburg?**
   (a) What are the processes and activities in the in- and outbound logistics?
   (b) What are the characteristics and performance of the involved processes and activities?
2. **Which critical activities and processes can be defined in the in- and outbound parcel process?**
   (a) How can waste be identified, in order to optimize the supply chain processes?
   (b) What critical activities and processes can be identified from the processes/activities at the Coolblue case?
   (c) What critical activities and processes are selected for re-design?
3. **What are the requirements, constraints and key performance indicators for a future state design?**
4. **What conceptual designs can be formulated for the critical processes defined in question 2C?**
   (a) What are known ways to optimize these identified processes?
   (b) How can the critical processes be redesigned?
5. **What is the expected performance of the in- and outbound process given the conceptual redesign?**

2.2 Problem

Because Coolblue's growth is stabilized around 25% per year, it's main goal is shifted from growing towards minimizing the costs per package in the coming 2 to 3 years. Coolblue mentioned that there are critical processes that are problematic in the logistic activities and these problems need to be solved to accomplish it's main goal. Therefore Coolblue would like to understand where in the logistic parts critical processes can be identified, and how to redesign these processes to increase efficiency, eliminate waste and finally decrease the costs per package. For this project a critical process is identified using two different definitions: (1) A critical process is as a process that results in waste, what means that the process is inefficient or that the process causes a bottleneck. (2) A critical process is the most expensive and most time consuming process, comparing the process with other processes in the logistic chain. These definitions are illustrated concise in Figure 2.1.

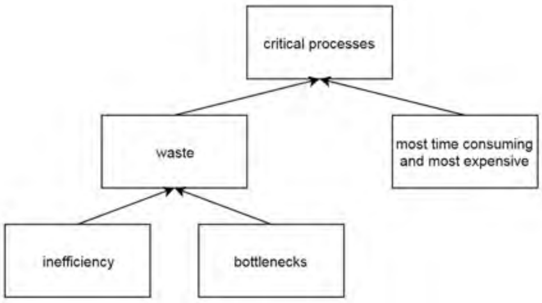

Figure 2.1: Critical Processes Identifying

In order to understand where in the parcel process waste is presented, a description of the current state is needed. For the representation of the current state a function model is used, what presents functions, activities or processes within the model system or field of study (Director and Technology, 1993). A well known function model is the IDEF0, which helps modelling hierarchical series of diagrams, text and cross-referenced that are related to each other (Director and Technology, 1993). Therefore an IDEF0 is designed for the current state of the parcel process of Coolblue.

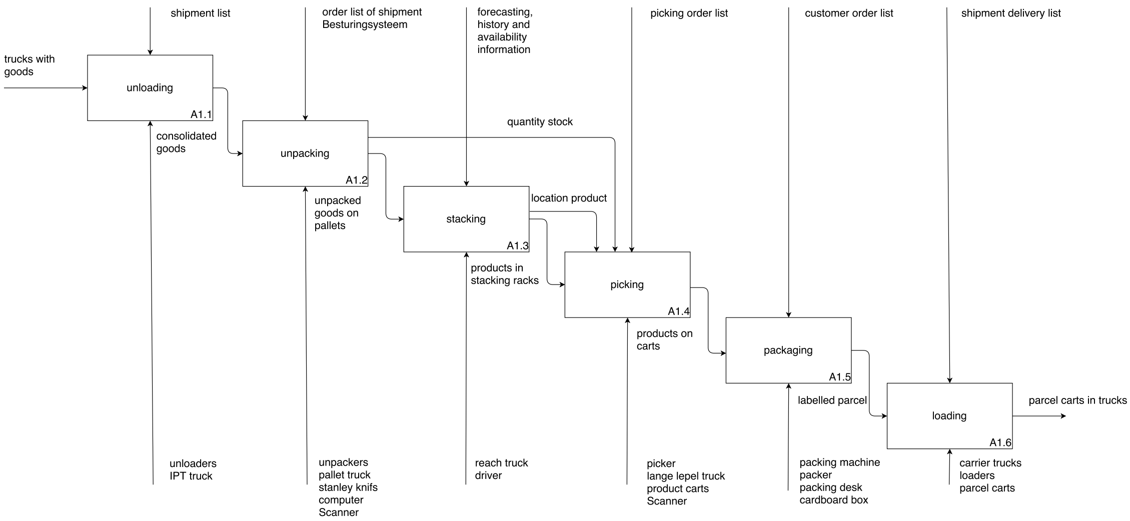

Figure 2.2: IDEF0 Diagram

As can be seen in Figure 2.2, the IDEF0 consists of boxes and arrows. The boxes present functions/processes and the arrows are data and objects that inter-relate these functions (Director and Technology, 1993). The arrows can be divided in four types: (1) A horizontal inward arrow indicates the input for a process and (2) a horizontal outward arrow indicates the output of a process. (3) The top vertical inward arrows imply the control needed for the processes and (4) the bottom vertical inwards arrows imply the resources needed for the processes.

The parcel in- and outbound process of Coolblue can be divided in six basic processes. The first process is unloading the incoming goods of the truck carriers, that are originating from different suppliers. Next, these goods, as they enter the warehouse consolidated, will be unpacked and will be piled up on pallets. During unpacking the goods are registered in the system. The third step is stacking these pallets with parcels in the racks. When a customer orders a product online, the fourth step will be executed, picking. After the orders have been picked, the orders are packed in boxes using Coolblue's unique packing machine. After the packing machine, the parcels are labeled and subsequently loaded on parcel carts. Finally, in the last step, the parcel carts are placed in the carrier trucks.

The six processes of the IDEF0 model will be elaborated further during the analyze part of this research, what will result in a deeper understanding of these processes and will help by finding critical processes.

2.3 Context Analysis

As already mentioned, Coolblue is a Dutch online retailer in electronics. The main competitorsin the Netherlands are other online retailers Bol.com and Mediamarkt. The biggest retailer of these three retailers is Bol.com, due the fact that they offer a more widely range of products than Coolblue and Mediamarkt. In the year 2016 the turnover of Bol.com, Coolblue and Mediamarkt were respectively 1 milliard, 614 million and 190 million euros (Twinkle100, 2017). When it comes to online sales of consumer electronics in the Netherlands, Coolblue is market leader. Also, Coolblue is the fastest growing retailer of these three online retailers.

2.4 Stakeholder Analysis

For this research, different stakeholders are identified and analyzed. This is necessary for acquiring a deeper understanding of why the operational processes take place as they do in the current state and for defining requirements for a future state design.The stakeholders are obtained out of Coolblue's annual report 2016 (Coolblue, 2017) and are presented in Figure 2.3 in an influence-interest diagram.

As the name indicates, this diagram illustrates the amount of influence and interest of a stakeholder. The expectations of these stakeholders, as published in the annual report, are as follow:

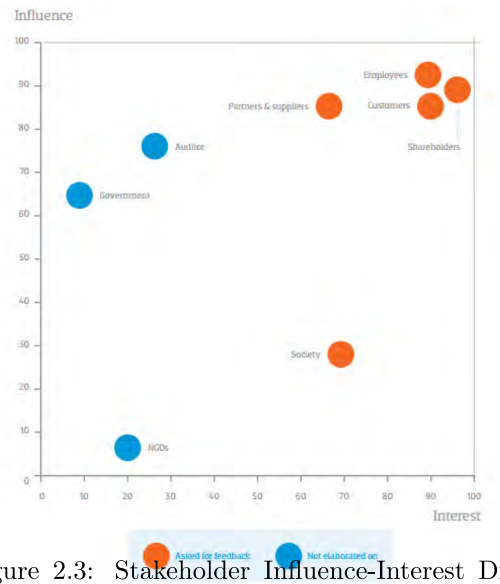

Figure 2.3: Stakeholder Influence-Interest Diagram (Coolblue, 2017)

Customers: They expect that Coolblue provides them a smooth customer journey, which means that they can order a package without any problems and receive their package on time.
Employees:The expectations of the employees are that Coolblue maintains a safe working environment, that it develops a culture built around friendship, it supports personal development and that it promotes diversity and equal changes.
Suppliers: Suppliers expect that Coolblue continuously develops their sales platform. Also they expect that Coolblue balance bargaining power with long-term supplier relationship development.
Shareholders: The expectations of the shareholders are that Coolblue has stable, capable and adaptive management and that Coolblue is transparent. Thereby, the expect that it maintains adequate risk management and that it is financially stable.
Society: The society expects that Coolblue reduces their wastes and that it allows employees to contribute to society. Also the society expects that Coolblue shares knowledge on entrepreneurship and technical matters.

3 Future State Analysis

3.1 Design Goals and Constraints

The focus for Coolblue has been shifted from growth towards cost reductions, while keeping a high service level. For the inbound/outbound process this means the goal is to have minimum costs while retaining a fast throughput. Therefore, for the future state the following design goals can be distinguished;

- Minimum inbound/outbound costs per parcel [€/parcel]
- Maximum throughput [parcel/hour]

These goals should be achieved by implementing a new design, keeping in mind several constraints in terms of service, time, costs, employees, space and type of design set by the management of Coolblue (R. Winkel, personal communication, February 12, 2018). These constraints will become more specific after a specific critical process has been chosen to optimize after the analysis phase.

- **Service**: The high service level of on time deliveries should remain (next or same day delivery).
- **Time**: The implementation of the design should be possible within 1 year.
- **Costs**: The payback period of the new design should be below 2/3 years, because of the fast growing and dynamic environment of Coolblue.
- **Employees**: The amount of employees needed for the inbound/outbound process should stay the same or become lower after implementation.
- **Space**: The design should be placed in the inbound or outbound packaging hall. The solution direction will not be to increase the space of these halls.
- **Type of design**: The redesign should be able to keep up with the dynamic nature of Coolblue and her fast growth. After implementation of the design the current growth in orders of 25% per year must be able to be retained.

3.2 Technical Perspective

The product of this research will be a redesign of one or several logistic processes in the inbound/outbound of parcels in the DC of Coolblue in Tilburg. These processes are optimized using a quantitative approach, possibly by automatisation or mechanisation. A design will be created, supported by data, which performance is quantitatively measurable.

Therefore technological knowledge and methods from several TU Delft courses will be used. For example, the courses *Analyse van bedrijfssystemen* (SPM1121), *Advanced Operations and Production Management* (ME44310) and *Logistics and Supply Chain Innovations* (SEN9720) will be used for the analysis and design phase.

3.3 Methodology and Tools for Analysis and Design

A Systems Engineering Approach based on Dym et al. (2009) is used because of the technical nature of this project. This approach is adapted by adding a Problem identification step because the critical process to improve first has to be identified. The last two steps (detailed design and design communication) will not be carried out due to time constraints. This adapted approach with relevant methods, tools and corresponding research questions is given in Figure 3.1.

- **Problem identification**: In this extra added step the current state of the whole inbound/outbound process and need of the client is analyzed. By observing the process itself and interview employees an IDEF0 is created which gives an overview of the current state of the process. By use of Lean and Six sigma optimization techniques the critical processes are found. Eventually the critical process (bottleneck) to adapt is chosen with a Multi Criteria Analysis (MCA).

- **Problem definition**: Objectives, requirements, constraints and functions of the future design of the chosen critical process are identified by observations, conducting interviews, and performing data analysis.
- **Conceptual design**: In this first stage of the design process concepts of candidate designs are generated. First with help of Quality Function Deployment (QFD) the demands for the design are transformed in quantitative parameters. Then a Morphological chart with design options is created with help of a brainstorming session and literature research.
- **Preliminary design**: The created conceptual designs are analyzed and evaluated using a Quantitative analysis. Furthermore an Impact-Effort matrix is created for each design.

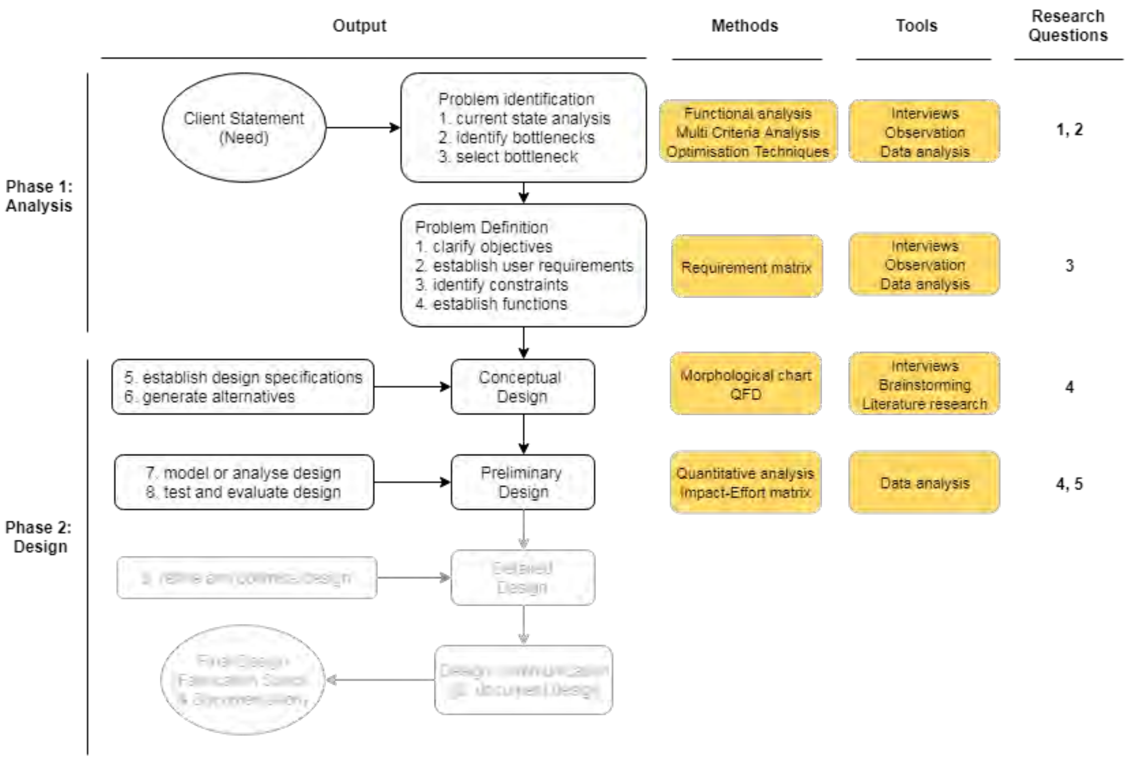

Figure 3.1: System diagram based on Dym et al. (2009)

3.4 Deliverables

The final report is expected to provide valuable insights for both the scientific community, for Coolblue and for the Tehnical University of Delft. The particle deliverable for Coolblue is expected to be a comprehensive slide pack with bottlenecks in the in- and outbound process and concrete advice in the form of improvements for these bottlenecks. For the university of Delft a comprehensive report is written, as stated in the course description of the course TIL5050 of the master program Transport, Infrastructure and Logistics. A final presentation is given to both Coolblue and the university where a functional appealing, convincing and clarifying design is given for the identified bottlenecks. The scientific deliverable is a framework to assess supply chain improvements in a highly dynamic environment. Coolblue, company which is experiencing enormous growth and changes annually, is used as a case study to test the developed framework.

4 Data Requirements

The scope of this project relies heavily on data for analyzing processes and measuring performance. At Coolblue, a large amount of data is collected, therefore most of the data need can be satisfied by using the company's database. It is important to extract the most relevant information from the database, and collect additional data where necessary. The project's analyses depend mostly on extracted data from the database. Some of the extracted data can be directly used for analysis, while other data might first need transformation in terms of metrics and build-up. Additional data needed for analysis will mostly involve observations and interviews with personnel. This chapter describes specific data requirements for the design project, a summary of all requirements can be found in table 4.1.

4.1 Data Requirements for Research Question 1

The current state of the Coolblue DC must be identified to answer sub question 1 of the research question. The data used for the current state analysis is subdivided among several topics; layout warehouse, overall process flow, activities, resources and system quantities.

Layout Warehouse
To get an overview of the operations at the DC, the first step is to identify locations, product zones, routes overviews and floor plans of the distribution center. This data is mostly available in the database, additional overview schemes can be created from observations.

Overall Process flow
The overall process flow consists of all the processes, activities and resources involved with in- and outbound logistics.

- *Processes*
  Using interviews and observations processes can be identified. The identified processes consist of sequences of activities. The lead times of the processes can be found in the Coolblue database.
- *Activities*
  For each activity, the following subjects must be known: queuing order, capacities, time required, resources used, and decision rules used.

The data collected for the overall process flow functions as input for the IDEF0 diagrams constructed for research question 1a and 1b.

Resources
Also part of the current state, is identifying the resources that are available. This includes identifying all the personnel, vehicles and equipment that is used in the system, and how many units there are of each. Also important for this is the schedule availability of resources, for example the length of work shifts, and allocation of full-time and part time workers during a work week.

System Quantities
The load on the system or system demand is determined by quantities that enter the systems. The system load consist of orders (virtual), and parcels (physical). For the orders, parcels (inbound) it must be known where, when and with what quantities they enter the system. Therefore, inbound parcel schedules, order patterns and outgoing parcels must be defined.

4.2 Data Requirements for Research Question 2

For research question 2 waste and critical activities and processes must be identified. Such analyses rely mostly on comparisons based on metrics and KPI's.

Metrics and KPI's

Metrics and KPI's are needed to compare the company's performance to their goals. To define critical processes, the most costly, time consuming and/or inefficient processes and activities should be identified. Measures of costs and time can be extracted from the database, or measured in case they are missing. Inefficiency, bottlenecks and waste are identified through comparing planned operations to actual operations:

- Compare productivity at different times of the day to KPI's for productivity.
- Compare lead times at different times of the day to KPI's for lead times
- Compare the resources used for parcel processes and activities to the resources available
- Identify the direct warehouse operation costs per parcel.

4.3 Data Requirements for Research Question 3

Research question 3 focuses on the future state of the DC based on the selected processes of question 2c. Prior to the design phase, the selected processes might need an additional amount of detail with respect to the system quantities mentioned in section 4.1. Furthermore, to create a valid design, (near) future forecasts of the earlier mentioned quantities should be gathered.

Answering research question 4 and 5 does not require any extra data. The data collected for answering research questions 1, 2 and 3, is assumed to be sufficient for the latter two questions.

Table 4.1: Data Requirements

Topic	Required Data	Data Source
Layout warehouse	Locations, routes, overviews and floorplan	Observations/database
Overall process flow	Processes, (sequences of) activities, involved attributes	Observations/Interviews
Activities	Queuing order, capacities, time required, resources used, capacity, decision rules	Observations/database
Resources	Resources available, schedules, capacities (if applicable)	Observations/Interviews/database
System Quantities	Incoming orders, order patterns, incoming packages, incoming logistics patterns	Database
Metrics and KPI's	Costs, lead times, shipments per hour	Database/observations

5 References & Literature

Before studying the processes in the warehouse in great detail, literature and reference projects concerning this topic is examined briefly. This way the research team can develop an eye for the important aspects of warehouse operations and obtain knowledge about technologies and similar companies' operations. First, a number of general findings and logistical methods from established papers and reports will be discussed, after which the new developments are discussed. Additionally, methods used by similar e-retail companies are looked at.

5.1 Warehouses in General

Warehouses can be split up into five main categories, namely distribution centres, private warehouses, public warehouses, automated warehouses and climate-controlled warehouses (Fullfilments, 2017). According to the definition given by Fullfilments (2017), "Distribution centers are warehouses where storing products is a very temporary activity. These types of warehouses are a point in the supply chain where products are received from suppliers, then rapidly shipped out to customers". Coolblue's warehouse is classified as an distribution centre.
Friederichs (2017) states that each warehouse has three main processes: inbound, storage and outbound. Inbound processes concern all the process from entering the distribution centre until positioning into the storage racks, while outbound processes flow visa verse. Outbound processes can be split up into two main activities, namely picking and packing.

Frazelle (2017) states that up to 55% of the warehouse cost are made in the picking processes. Frazelle (2017) states furthermore that currently four main picking processes are used, respectively "picker to part", "part to picker", "sorting systems" and "pick to box". The "picker to part" processes is most common because of the low investment cost of this system. Wheeler (2014) categorized the picking process by the behaviour of the picker in the warehouse. She makes in a distinction in four main concepts discrete order, zone, batch and cluster picking. Also combinations of the above are possible. If a company uses the discrete order picking to pick her orders, the pickers picks the orders one by one. The picker only starts picking a new order if he finished the one before. In the zone picking process, one picker is assigned to each zone, and only that picker picks products in that zone. This leads to less waste in terms of waste of movement of man and material. In a batch picking process a picker may pick products for multiple orders at a time. Last, in the cluster picking process the picker sorts the products related to a single order in a special tote. No additional, sorting is needed afterword.

5.2 State-of-the-Art Warehouse Technologies

As the efficiency of warehouses are critical to the overall supply chains they belong to, new technologies are being tested and adopted in the industry to improve the performance of warehouse operations. These technologies can be used to improve human performance or even totally replace human work.

Augmented reality, for example Google glasses, can be used during warehouse operations to improve human performance during receiving, storing, picking and shipping. Stoltz et al. (2017) pointed out this technology might be promising because it reduces human error rate, speed and flexibility because the employee doesn't have to carry a device. Some barriers are costs, acceptance by employees and software challenges.

Another technology which is used at large online retailers' distribution centers is the use of mobile robots instead of manual picking. These systems are more efficient and reduce injuries to warehouse employees because workers only need to monitor stations. Amazon robotics produces a specific type of these mobile robots which hoist racks and bring them directly to stationary pickers Yuan et al. (2016).Coolbue recently started testing with the use of mobile robots instead of manual picking. The main drawback for Coolblue is the type of products the sell are not suitable for these kind of robots.

5.3 Reference projects

Many leading companies have optimized their distribution centre using automation and robotizing. Although the goal for this project is not to design a new automatized warehouse, these reference projects can help to identify possible solutions for processes within the DC. Pierce states the leading companies in the world in terms of efficiency DC's are Amazon.com, IKEA and Nike. These companies achieve high efficiency in through automating their key processes. Doing so, these companies eliminate most waste related to unproductive labour. Drucker (1999) states that the most valuable assets of a company in the 21st century are their workers and their productivity. Therefore, if the throughput of a DC is large enough, the initial investment related to the automation will still be profitable.

Coolblue is smaller than the previously mentioned companies in terms of throughput (Coolblue, 2017). Furthermore, the scope of this research has implementation time of 1 year (Chapter 3). Therefore, the leading companies in the industries are not a suited reference point for this study. The main reason is that these companies apply a "package to picker" approach in the DC, the inventory is brought to a picker. This picking process requires large amounts of automated processes, and is therefore not achievable to implement in one year and also not desired by Coolblue with the eye on flexibility.

More relevant references can possibly be found in companies like PostNL, VanDerLande and Bol.com. These companies apply the same 'picker to package' strategy at the warehouse, and might apply interesting techniques that could appeal to Coolblue's DC as well. A short study into these, and possibly more, similar companies is conducted for research question 4a. The knowledge obtained from studying reference projects can function as inspiration for improving and redesigning critical processes at the warehouse of Coolblue.

6 Planning

Our planning diagram (Figure 6.1) spans from February until May 2018, also taking into account exams, holiday and preparation time for coaches and the team. The first phase of the project contains the preparation for the kick-off meeting. A first meeting with Coolblue in the DC in Tilburg helps defining and scoping the project. The PVS is created and a Belbin test is performed with all team members. A presentation and discussion about the PVS content during a meeting is required for proceeding to the second phase.

The second phase is a detailed analysis of the current state is performed and the critical processes are identified. Eventually, a couple of critical processes or activities are chosen to discuss and inspected in more detail. Data collection and literature research are of great importance in this phase in order to find the most critical parts for re-design of the in- and outbound process. During this phase, the first chapters of the report will be written. Findings and developments are discussed during a mid-term meeting. This meeting is expected to be after four weeks of research after the kick-off meeting.

The next, and third, phase contains the development of possible re-designs of the involved critical processes or activities. The KPI's for the re-design are formulated, re-designs are developed, the impact of these re-designs on costs/package is modelled and verification and scenario analysis are performed. For the green light meeting, expected to be three weeks after the mid-term meeting with a workload of 3-4 days a week per team member, 90% of the report must be finished. The team should pass the GL with a sufficient grade to enter the final phase. In the final, fifth, phase the report is finalized, comments are incorporated and preparations are made for the final presentation. The final presentation is expected to be after 2 or 3 weeks after the GL meeting.

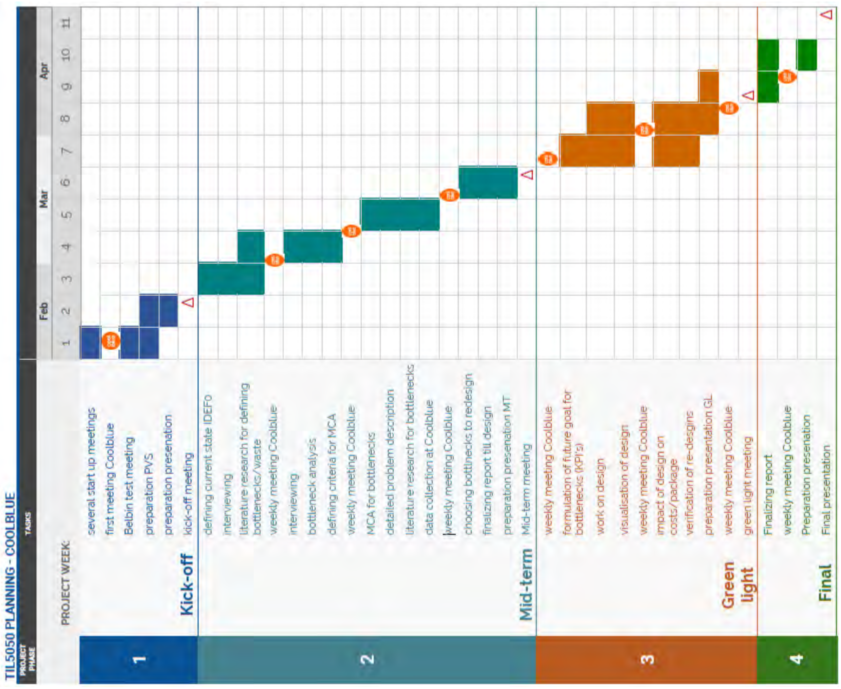

Figure 6.1: Planning Coolblue project

7 Belbin Test Summary

A Belbin test is performed by all team members before the start of the project. A Belbin test helps to identify team roles and identify key strengths and weaknesses of each team member individually. A person does not have one typical role, but has more then one. Below four team role types per team member are discussed.

Berend
Berend is a complete finisher, co-ordinator, shaper and resource investigator. He takes care of a good vibe when the team needs to tackle an hurdle. Berend always challenges the team to improve the work, and makes sure every is right by double checking the deliverables, but sometime this could result in taking his perfectionism to extremes. He has a eye to identify talent, but sometimes offload his own share of the work.

Belle
Belle is an implementer, monitor evaluator, shaper and team worker. Belle is practical and efficient and judges accurately. Her strength is working in a group, where she is a real listener. Belle finds confrontation difficult, and can be sometimes be over critical and thus slow down decision making processes.

Stephanie
Stephanie is a shaper, implementer, co-ordinator and complete finisher. Stephanie has a real drive to overcome obstacles, and approaches this in a practical and efficient way. Goals are always clarified really clearly, which helps when defining tasks in a group. Stephanie has a high quality of control, which sometimes could result in extreme perfectionism and difficulties in getting the job done before a deadline. Stephanie is a little prone for provocation, and less flexible to new possibilities due to the presence of the practicality.

Nienke
Nienke is a shaper, plant, complete finisher and resource investigator. Nienke is creative, and loves to solve difficult problems. She likes to explore opportunities and polishes and perfects the details. Although Nienke has a free-thinking mind, sometimes she is absent-minded and the team needs too help her paying attention to the situation.

Patricia
Patricia is a co-ordinator, shaper, resource investigator and implementer. Patricia clarifies goals, and draws out team members and delegates work. She has a drive to ensure that the team keeps going, but sometimes this drive could results in negative feelings among other team members. Patricia is enthusiastic, and loves to explore opportunities and develop contacts.

Conclusion
After the Belbin session the team got the opportunity to understand each other competences. We can conclude we have a diverse group of team roles in our Coolblue project team, and we could help and stimulate each other to achieve our potential.

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