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# Recommendations for an Improved Delivery Process after Business Model Change

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*"It is dangerous to go alone. Take this!"*

It has been a busy winter and spring. Finally, in the end, all the effort is tangible, and held by you as a thesis book. My thanks first of all go to the management for giving me the opportunity to take on this thesis topic. The upstairs crew for answering just about any question when they arose during the writing process. Production planning and their brutal honesty were important during the times when a problem occurred. Dispatch crew, you caught everything that slipped between my fingers. Production for being behind the writing process right from the beginning and being critical of the suggestions given. Finally, thanks go to the Material Handling staff: If it didn't feel or sound right, you said it right away with experience and reason

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Vantaa

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<p>This thesis describes the objective of the case company to improve functions within the delivery process after the case company had a shift of focus from a service-based business model to a retail-based one. The previous business model was based on a make-to-stock style of production, which enabled pushing of long production orders of a single product into stock and stockpiling of materials accordingly. The retail-based business model has a much faster-paced shorter ordering window, which makes production planning, forecasting and material procurement more challenging.</p> <p>The objective is approached by describing the current state delivery process and identifying the issues in it together with the stakeholders in the different functions of the delivery process. The current state analysis described both the strengths and weaknesses of the delivery process. The main issues were identified in the functions that both initiate and enable production: Production Planning and Material Handling. The issues were then explored in literature, utilizing practices and tools used in the industry, to create a conceptual framework. The conceptual framework was then used together with suggestions from the stakeholders to build an initial proposal.</p> <p>The outcome of this thesis is a list of recommendations for the case company to improve on the weaknesses and issues found in the delivery process. The list of recommendation includes suggestions on reviewing customer service level, forecasting accuracy and making the material handling department overall leaner.</p> <p>By implementing the recommendations, the case company can better support the value making production by removing the bottlenecks brought by the remnants of the service-based business model, with implementations in the higher levels of the organization having a compound effect on the functions below them. These implementations would then enable the functions of the delivery process cut down on costly wastage due to more accurate forecasting and improve reaction and lead times due reorganization of the storage department.</p>	
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## 1 Introduction

As companies compete in the evolving markets of the food industry, a certain focus is needed in their production processes to address both the needs of the customer and to keep the process free of excess. Removing this excess left over from obsolete practices or previous operating models can be a challenge, as old habits tend to die hard.

One result of inefficient practices are invisible financial costs that are incurred as production processes remain the same despite a need of a shift in production capabilities. Another is the impact on lead times and general flexibility. These obsolete practices can be extremely detrimental to the goal of staying both competitive and profitable.

### 1.1 Business Context

The case company is a Finnish middle-sized company founded in 1985. The case company was bought by its present owner in 2014 and was renamed. The case company specializes in making takeaway, convenience foods and bakery products including their own private label products for use in the Hotel, Retail and Catering sector. The case company also produces food and catering services for airline needs.

After the ending of a contract for an airline service customer, the case company decided to shift business focus from the Airline Service to a Retail focus. The previous focus followed a model of operations which was a quarterly, long-term plan with specific products for each part of the rotation. The new model, where retail production is the focus, requires more short-term planning: Less focus on ordering materials in bulk for long-term storage, more focus on having fresh materials in hand as-required due to more restrictive product expiration dates.

This thesis focuses on the delivery process of key products of the company to highlight deficiencies within the whole process. Starting from sales to production planning to purchasing to production and finally delivery to the customer. The daily rhythm of the retail-based products requires more fine-tuning than the quarterly pre-planned model regarding product volumes on a customer basis.

## 1.2 Business Challenge

A shift from the previous long-term planned service-based business model leaves the delivery process of the company inefficient. The whole delivery process needs development from the ground up for cost-effectiveness to eliminate waste and increase profitability in the long run.

As the company delivers products to major retail chains, it is important to retain those customers by upkeeping high quality product standards combined with reliable delivery times to keep them happy. Due to the short-term product focus, by planning future requirements, carefully coordinating between departments and monitoring the production process, these goals should be attainable.

## 1.3 Objective, Outcome and Scope

The thesis objective is to suggest improvements to the delivery process: From sales first receiving the order, to production planning, and purchasing, having the necessary talent and material, to the actual production to finally dispatching the finished product to the customer.

Currently, long-term planning is visible from order lead times, storage placement and material ordering sequencing – production for each week is pre-planned more than a week in advance, relying on a forecast based on previous, genuine orders. This is detrimental, as excess amounts of materials in storage bring additional costs in both storing and handling. Food industry materials are also prone to spoilage, which in turn causes only negative revenue from purchase to storage to disposal costs.

The outcome of this thesis is a proposal for an improved delivery process, in the form of a plan or a roadmap with the proposed improvements.

This thesis examines the different factors that affect the delivery process. The thesis describes the practices within sales (customer communication regarding lot sizes, order placement timing), production planning (material and personnel planning) material handling (regarding purchasing, receiving and storage practice), production itself (planning,



preparation and production) and delivery timing (both planned and in practice in the dispatch department), to identify the weaknesses. Though this, it is possible to search for improvement methods. The goal is to have analysis of the processes that are a part of the delivery process of a fresh made product such as a takeaway sandwich and a frozen convenience food. By proxy, the same processes support the making of other in-house products.

This was conducted via a current state analysis to current practices regarding the delivery process for these key products of the company. This information was used to suggest a proposal for a roadmap that would improve the delivery process via more efficient practices to reduce the amount of perceived wasteful practices and decrease operating costs.

## 2 Method and Material

This section describes the research approach, data collection and analysis methods used in this Thesis. The section also describes the criteria used for the evaluation used for the study.

### 2.1 Research Approach

Research, the systematic search of information, is the one of the foundations of making business decisions. By applying research to company functions, logical and analytical techniques can be used to solve optimization problems or minimizing costs. Research can provide not only the theoretical basis in the form of new knowledge, but applicable, practical knowledge in the form of new ways to work as well.

A necessary part of any research is selecting an appropriate research strategy. A research strategy sets the guidelines for the contents of the research. Different research goals call for different approaches, which allow for a variety of procedure with which to approach a topic. These procedures differ from each other in terms of how data is collected, analyzed or generally, which topics they are best suited for. While some research strategies overlap with each other, the differences are significant enough between them to make each suitable for different topics. (Yin 2003)

For the research method in this thesis, applied research was chosen. The business challenge is relatively specific to the case company, i.e. attempting to recommend improvements on issues encountered with the end goal of reducing inefficiencies, in which applied research is helpful. Another feature of the applied research, according to Dudobskiy (2011), is that the objective is set by the 'customer', in this case, the company itself. The result of this study would then be applicable knowledge, specifically to the issues encountered in the research.

Part of the of the research is akin to case study methods, as described by Brown (2017), due the proposal in this study not being a set of continuous, pre-planned additions which would then be reconsidered after another cycle of observations, but a set of recommendations.

As the issues encountered in this thesis are inside the case company, the results of the analysis into these issues are validated mainly by external sources. In the case of this thesis, the stakeholders of the company validate the improvement proposal rather than internal validation.

Due to the use of applied research as the research method, as described by Dudobskiy (2011), this thesis would mainly lean on the usage of qualitative research as an approach to the analysis of the problem. The basis for using a qualitative research approach in this thesis are the differences between the natures of work done in each step of the delivery process. The research would then find that factors that affect the functions within the delivery process. The findings are then described, and their impact analyzed rather than using numerical data for comparisons as qualitative research does, done quite much in line with the view of, for example, Anderson (2006) on doing qualitative research.

As per the description of qualitative research, a multitude of data was gathered via personnel interviews and internal data documents related to process. This qualitative data was complimented with relevant quantitative data accordingly to find the impact of the issues encountered in the delivery process.

## 2.2 Research Design

This section describes the research design approach of this thesis.

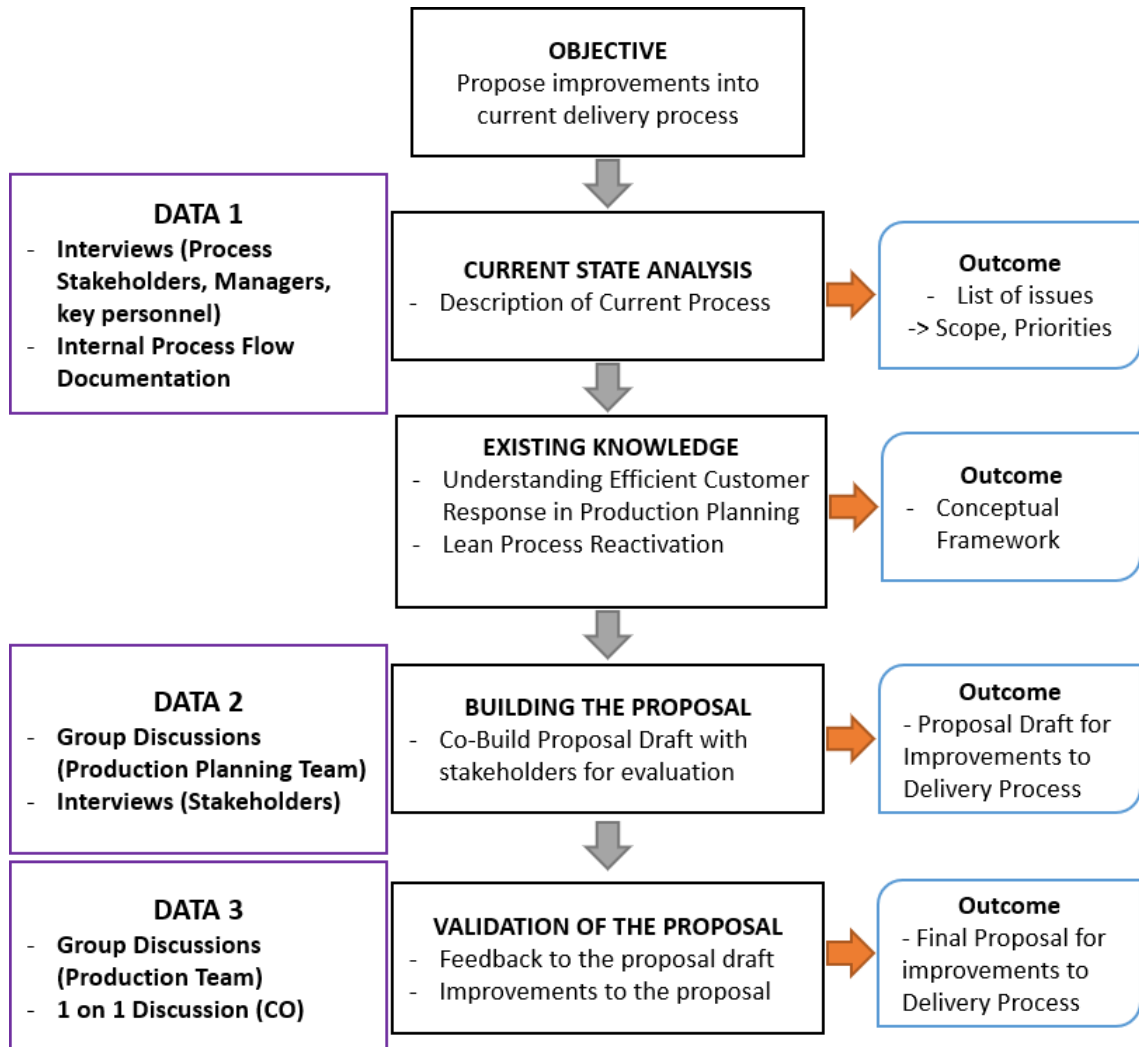


Figure 1. Research design illustration.

As Figure 1 shows, the objective of this thesis was make suggestions to the current delivery process in the company. After the objective was determined, a current state analysis was conducted by examining the current delivery process and interviewing key personnel in each stage of the delivery process. The target of the current state analysis is to understand the delivery process, describe the practices used in each stage of the process and define issues in the delivery process. The outcome of the current state analysis was a list of issues encountered and a focused scope for the thesis.

The next stage was consulting existing knowledge of the field regarding best practice. This was then used to define a conceptual framework for the thesis. The next step was to build a proposal for evaluating the initial proposal draft. Key members of the production planning team and company representatives were interviewed for the specific needs of their stage of the delivery process when referring to the issues encountered in the initial data collection process. Based on the second round of data collection and existing knowledge, a proposal draft was created. The final step of the thesis research process was to validate the proposal and improve it with the feedback gained from key stakeholders. This information was then used to build the final proposal for the improved delivery process.

### 2.3 Data Collection and Analysis

This study draws from a variety of data sources collected in three data collection rounds. The first round collected Data 1 for current state analysis as shown below in Table 1.

Table 1. Details of respondents, data type and discussions in Data 1.

	Participants / role	Data type	Topic, description	Date, length	Documented as
	<b><i>Data 1, for the Current state analysis (Section 3)</i></b>				
1	Respondent 1: Material Handling team and manager	Workshop / Face-to-Face Interview	The material handling section (purchasing, receiving and storage of materials) of the delivery process	Jan 2018 Week 4 60 mins	Field notes
2	Respondent 2: Sales/R&D Team	Workshop / Group interview	The sales section (sales, product specification, customer relations) of the delivery process	Jan-Feb 2018 Week 5 45 mins	Field notes
3	Respondent 3: Production planning team	Workshop / Group interview	The production planning section of the delivery process	Jan-Feb 2018 Week 5 30 mins	Field notes
4	Respondent 4: Production workers	Interviews	Grassroots, worker level view of production process	Feb 2018 Week 7-8	Field notes
5	Respondent 5: Dispatch team and Manager	Face-to-face Interview	The dispatch section of the delivery process	Feb 2018 Week 7-8 30 mins	Field notes

6	Respondent 6: Production Manager	Face-to-face interviews	How the production goes from a managing perspective.	Mar 2018 Week 10 45 mins	Field notes
7	Respondent 7: Company Managing Director	Face-to-face Interview	Interview about current process related to the respondent experiences	March 2018 Week 13 45 mins	Field notes E-mail correspondence
8	Respondent 8: Group Senior Project Manager	Face-to-face Interview	Interview about company process related to delivery process	April 11th	Field notes E-mail correspondence

Data 1, as show in Table 1, was collected mostly by referring to the company internal process documentation and then comparing it with the practical experience data gathered from the interviews. This data not only included the process description of each part of the delivery process by the key personal involved in the process, but also the issues encountered during the process, issues surrounding the process and following the process. Initial suggestions by the interviewees were also gathered as a part of the encountered issues data.

Table 2. Details of respondents, data type and discussions in Data 2.

	<b>Data 2, for Proposal building (Section 5)</b>				
9	Respondent 8: Group Senior Project Manager	Face-to-face Interview	Proposal building	April 11th	Field notes E-mail correspondence
10	Respondent Team: Production Team	Discussions, Face-to-face interviews	Proposal building	March-April 2018	Field notes E-mail correspondence

In the next round, Data 2, which is seen on Table 2, was collected to gather suggestions for developing the proposal. This data included reviews of issues encountered by the process focus groups and initial suggestions by the focus groups from Data 1 as a basis for the initial proposal.

The final set, Data 3, as seen on Table 3, was collected when receiving feedback for the proposal from the case company.

Table 3. Details of respondents, data type and discussions in Data 3.

	<b>Data 3, from Validation (Section 6)</b>				
11	Respondent Team: Delivery Process Team, Managing Director	Group interview/ Final presentation/ 1-on-1 discussion	Validation Evaluation of the Proposal	April 19 <sup>th</sup> , 2018	Field notes and recording E-mail corre- spondence

In this study, interviews were conducted both during group meetings and face-to-face. The interviews conducted in group meetings were open-ended so that differing points of view on how a part of the delivery process should go could occur, to highlight possible issues from different approaches or interpretations of process flow. Each interview was then concluded with an inquiry into the biggest issues in the process according to the people responsible for that stage of the delivery process. These issues were then collected into field notes.

The questions for the group interviews can be found in Appendix 1, Field note log form. The interviews were written down into field notes, which were transcribed into the weaknesses and issues found in Section 3, Current State Analysis.

Table 4. Internal documents used in the current state analysis, Data 1.

	<b>Name of the document</b>	<b>Number of pages/other content</b>	<b>Description</b>
A	FD3.01 Company Retail/Catering service flow	1 page	Process description via flowchart
B	FD3.02-FD3.10 Company retail/catering service flow Subprocesses	10 diagrams	Diagrams for Operational Processes
C	LSG Sky Chefs Production System Management Booklet	52 pages	Guidelines used for production processes
D	Production key figures charts	6 pages	Descriptions of items produced per day, daily wastage and their costs, delivery reliability, production changes or stoppages due to material stoppage, work safety observations.

As seen on Table 4, the thesis also analyzed a number of internal documents relevant to the subject. The main documents included the internal process flowcharts and internal process guideline documents of the case company. The documents were analyzed for the current state analysis, Data Collection 1 to get an understanding for the flow of the delivery process starting from first receiving a purchase order for a specified product from a customer to finally dispatching the product to the customer.

Data collection also included a number of key production figure charts from daily production town hall meetings. These key production figures included amount of personnel present, for amounts delivered, daily production deviations/stoppages and amount, reasons and costs incurred by material wastage. These figures were used both for determining the severity of issues encountered and as a starting point for finding the root cause of the issues encountered.

The data collections were all analyzed using content analysis to examine and pinpoint the themes within the data to describe the process. By triangulating the data gathered, the issues encountered could be confirmed weaknesses. Single statements themselves could be the opinion of the interviewee rather than a general statement of the state of matters. Multiple sources of information help affirm the status of an issue encountered to be a weakness.

Major part of the data analysis in this thesis was done for the current state analysis stage to establish the current state of the delivery process. The findings from the current state analysis are discussed next, in Section 3.



### **3 Current State Analysis of the Current Delivery Process**

This section discusses the current state analysis of the thesis. The current state analysis is split into three sections: The overview of how it was conducted, the current state analysis of the roles of the different departments in the delivery process and a summary of the analysis.

#### **3.1 Overview of the Current State Analysis Stage**

The current state analysis was conducted by first reviewing the company internal process flowcharts to describe the delivery process in theory. The flowcharts present the delivery process in each of the stages as they are specified.

The second step was to interview the personnel responsible for that stage of the delivery process. The interview was conducted by first describing the current process and then asking the interviewee to point out deviations in the process flow, if any. The interviewees were also asked to report any issues encountered in the process from their point of view, with possible initial suggestions to the issue if any had been thought out.

Third, the issues from each department were gathered to a workshop where overlapping issues could be separated, and a possible root cause could be found.

#### **3.2 Current State Analysis of the Delivery Process of a Generic Product**

For the purposes of this thesis, the delivery process of a generic cold takeaway product is described. In the process described, the product is considered to have been specified and designed to customer needs and is currently in a state where it may be freely ordered by the customer. This product could be substituted for a salad or another sort of meal-ready-to-eat by proxy.

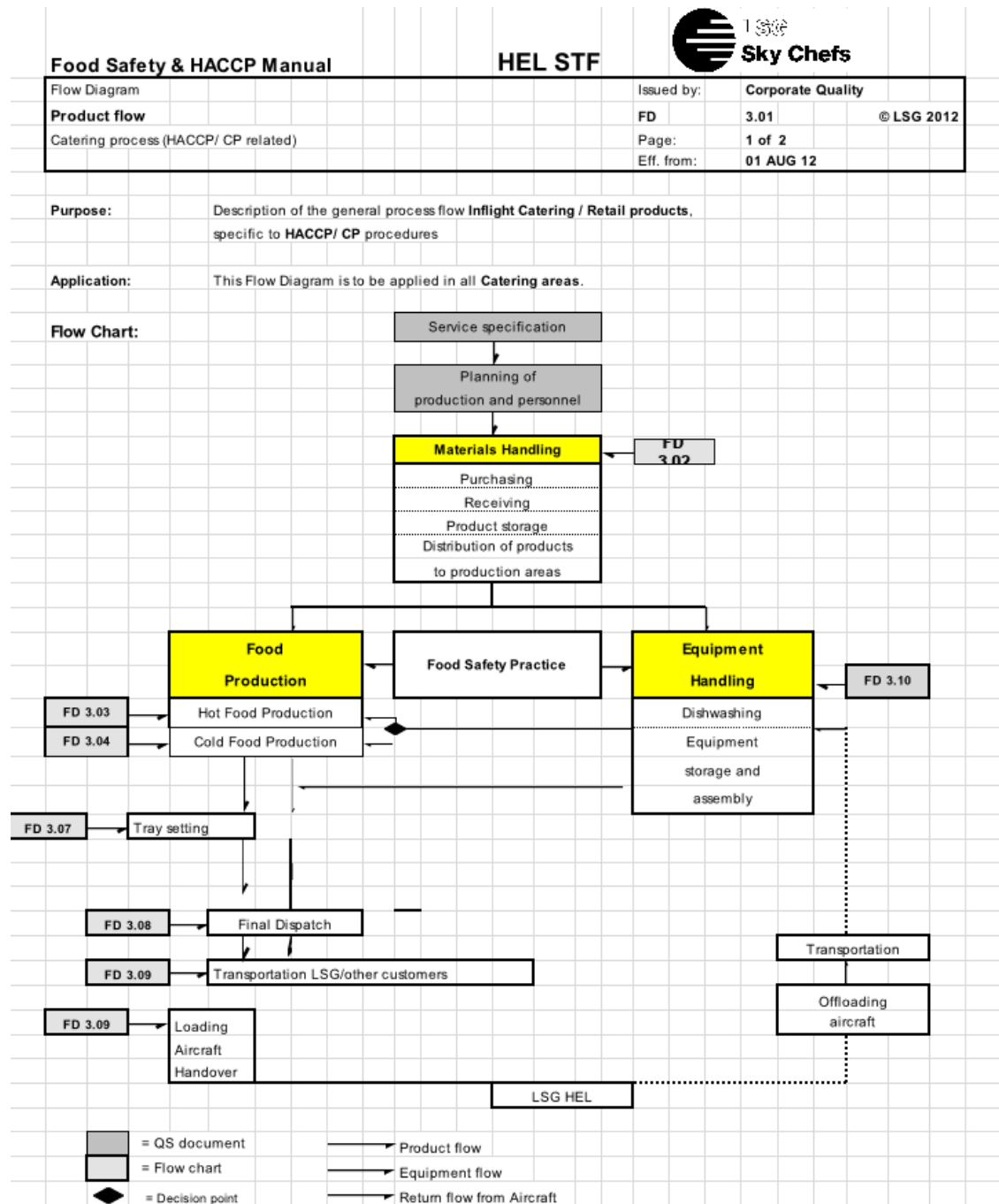


Figure 2. FD 3.01: Company Retail Product General Process Flowchart

In Figure 2, the current general process of the case company is described in flowchart format, being based on the hybrid service/retail process flow. The delivery process for the generic takeaway product starts from planning of production and personnel as sales receives the order. The delivery process description starts when the customer makes a purchase order. The production order then moves to production planning, which determine what Material Handling (FD3.02) purchases and stores, how much labor Production

requires for the product to be assembled and with which amount of materials (FD3.04) and finally, what Dispatch does with the assembled product (FD3.08)

As the previous flowchart contains superfluous steps, the flowchart is streamlined below in Figure 3, Streamlined general retail process flowchart.

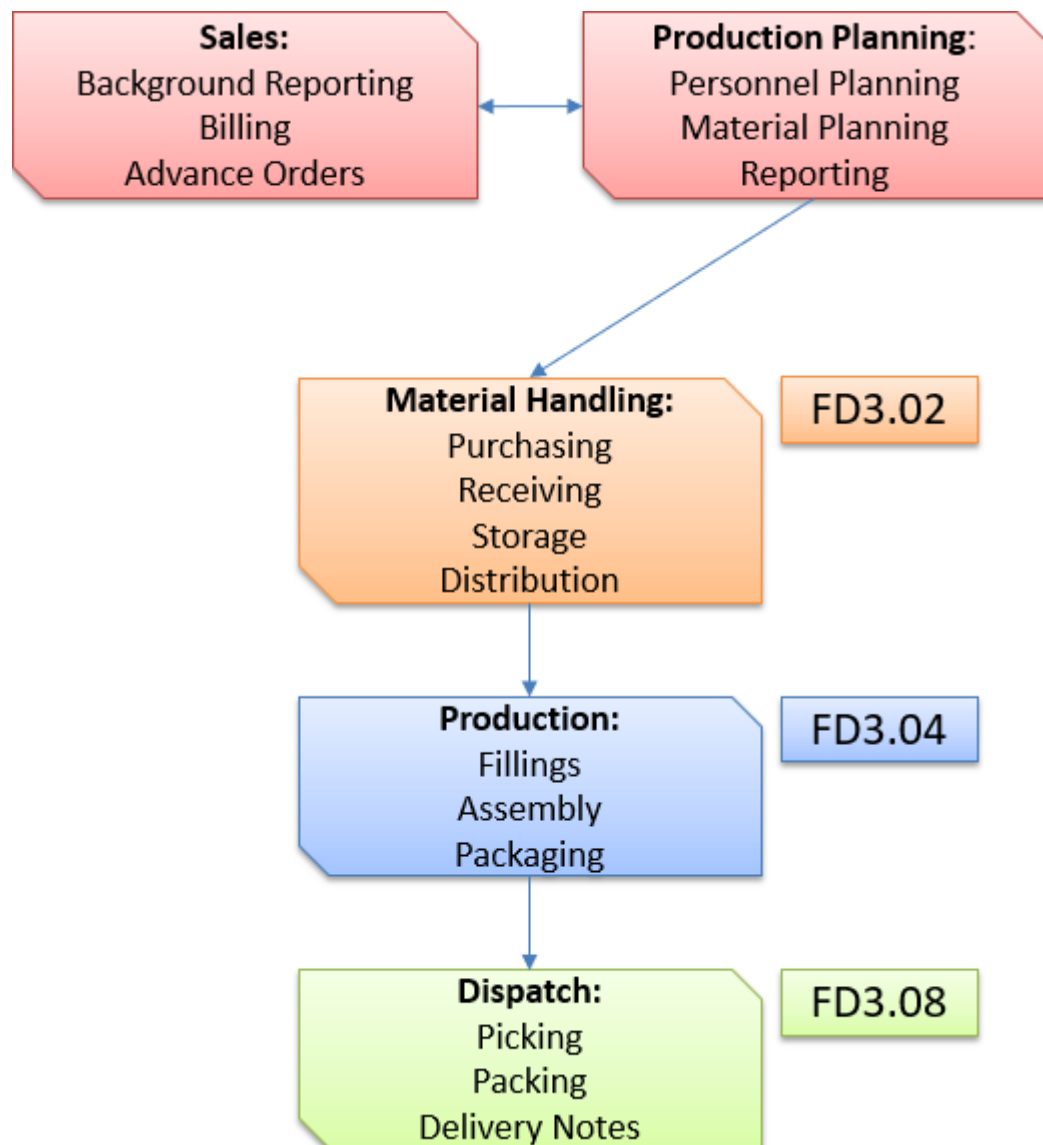


Figure 3. Generalized Retail Process Flowchart.

As seen in Figure 3, the delivery process is divided into 5 departments. Each department has their roles in the process, with some roles overlapping to outside departments depending on how the process flow executes.

The first interface the order of a customer has is in the Sales department. As sales and production planning run very close to each other with some overlapping functions, they are described as happening simultaneously. Following the production order receiving the personnel and material requests, material handling takes care of purchasing, receiving, storage and distribution of materials. Following the distribution of materials, production takes care of the product assembly itself, finally delivering the finished goods to dispatch. Dispatch is the last step, where the product is packed for delivery and handed to the transportation services which deliver the order to the customer.

### 3.2.1 Sales and Production Planning

The first stage of the delivery process starts in Sales and Production Planning. The investigation found that there was no real process flowchart to use as a basis for the description, so the description is based on the interview transcriptions and observations in the daily town hall meetings.

The delivery process starts when a customer has made a purchase order for a certain number of products to be delivered. The sales department receives this amount through either Electronic Data Exchange (EDI) or by e-mail order. This order is also received as a carbon copy by production planning in most cases. Production planning then makes a production order based on the specifics from the customer. The production order is based on the product specification. The production specification is made according to the wishes of the customer by sales and R&D. The product specification determines the amount of labor, materials and time required for completing the production order.

Depending on customer, the amount ordered may either be from a forecast which is delivered a week in advance or a confirmation order for the delivery of the next day. For example, the weekly advance order for the first delivery of the week is 800 units, but the confirmation order received on the day before delivery is 850 units, meaning the units need to be produced during the initial run or at a later hour depending on when the confirmation order is received.

In the case of non-forecasted orders, the minimum order time has been determined to be 48 hours before delivery to adjust for any necessary purchases and changes in labor requirements.

In summary, sales functions as the customer interface in the delivery process. Sales handles both incoming orders and some of the outgoing invoicing. The sales department is usually the first step in the customer reclamation process as well – in the case of logistical or production halts, they take care of customer communication: Substitute methods, additional deliveries or compensating in invoicing. Due to being a part of invoicing, the sales department also has a role in background production reporting as well.

The sales department is partially responsible for the billing process for smaller customers – larger customers are handled by the LSG unit in Germany. The sales department is also responsible for customer reclamations relating to logistical issues and – in the case of production stoppage, the sales department then informs the customer and makes the necessary arrangements for either additional deliveries or making credit note for the missing products. The next logical step after sales has a production order is production planning.

Every Tuesday, a production planning meeting is held to deal with topics regarding both the on-going production of the ongoing week and forecasted production of the next week. In this meeting, staff from sales, production planning, material handling and production gather to input issues or current events in their own departments.

In the case of extra orders or new products, representatives of each department are present to react to the orders accordingly – material handling makes the necessary purchases, production prepares and produces the products and dispatch makes the arrangements for any deviating delivery times.

The roles of production planning, outside the planning itself, are assigning and reporting production orders. Production planning is also a part of the inventory keeping process, where the amounts in SAP are compared to the physical storage and updated accordingly.

Production planning has coverage to just about every other aspect of the delivery process. Production planning acts as the middleman between departments and are responsible for keeping books on the progress of production orders, as production team leaders report on finished products. The production planning personnel are also the experts on the usage of the in-house ERP, SAP which functions as the production planning and inventory management tool.

Table 5. Weaknesses and Issues encountered in Sales and Production Planning.

	<b>Weakness / Issue encountered in Sales and Production Planning</b>
1	Sales: "Due to production relying forecasts, production must be planned a week ahead. Most customers specify the amounts ordered under 12 hours prior to dispatch."
2	Sales: "One part of billing is done manually, and another Germany. This can lead to some disruptions in the billing process, as settling issues of both parts are done locally. Double checking is required to see that the issue has been corrected in the other end."
3	Sales/PP: "Orders come to both production planning and sales, can lead to confusion."
4	PP: "Most products need at least 24 hours of preparation or material procurement time, if unforecasted, major increases to production orders occur."
5	PP: "As there is no minimum order amount, small extra orders on day prior to dispatch cause lots of manual work."

As shown in Table 5, the weaknesses encountered in the processes are mostly related to the short order windows from the customers which leads to a need to make advance forecasts which may not always be accurate. A lack of minimum order amounts is also seen as a problem in cases where the original forecast is met, but there is an extra order from a customer during the same day the original forecast is supposed to be delivered.

### 3.2.2 Material Handling

After sales has received an order and together with production planning, has a production order ready, Material Handling is the next step in the delivery process.

The material handling process investigation was conducted by reviewing the internal process flow chart with the employees assigned to these processes, main sources of information being the storage employees, purchasing manager and the supervisor of the storage department. After going through the process with key members of staff, the findings were compiled together as described below and made into a visual format in the form of a flowchart.

This information was also fact-checked with the Quality Assurance manager who oversees matters of food safety and hygiene. Finally, each member of the team was interviewed on the process flow. Issues that arose from these interviews were recorded for reviewed with the team for improvement suggestions. Material Handling (Figure 3) contains several sub-processes as described below.

For the purposes of this thesis, the process described is the general practice in material handling, meaning it may contain some elements that may not be used in the production of the generic cold takeaway product otherwise described.

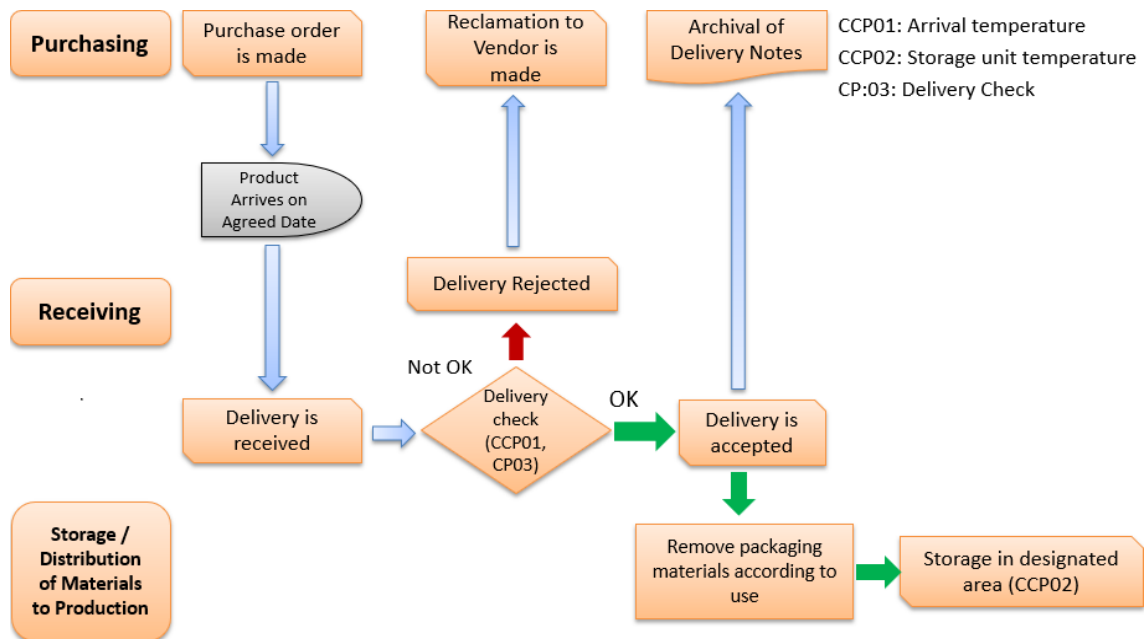


Figure 4: FD3.02 Material Handling Flowchart

The material handling process (as shown above in Figure 4) is divided into four sub-processes: Purchasing, Receiving, Product Storage and Distribution of Products to Production areas.

### 3.2.2.1 Purchasing

The first sub-process, purchasing, orders materials according to orders received by sales. Sales then forwarded the orders to production planning who build the recipes which contain the material amounts for the orders.

The Purchasing manager together with R&D, has negotiated the materials and the vendors with whom purchase transactions for the materials are to be made with. A purchasing assistant (in-house title: “Kotiinkutsuja”) makes a purchasing order to a vendor. The vendor then confirms the purchasing order for the purchasing assistant. The purchasing assistant then edits the delivery date in the system for the receiving process if necessary.

Vendors typically have a 24-hour to 48-hour delivery time, but this may vary, depending on several factors. Most common material vendors (i.e. frozen products, dairy and fresh produce) can do next-day deliveries if the purchase order is submitted before 13:00 on



a business day. The 48-hour order cycle products are mostly from the logistics centers of bigger wholesalers, who collect the products from their own vendors for deliveries.

In the case of expedited deliveries outside the regular window, expensive additional costs can occur. Worst case scenario being a complete halt in production due to a lack of materials. These costs can be mitigated via a local cash & carry wholesale vendor in cases where the product is critical and in manageable amounts.

When the purchasing process is completed, and the ordered material has arrived on an agreed day, the next step in the material handling process is Receiving.

### 3.2.2.2 Receiving

In Receiving, a storage worker has several steps to check whether a delivery is acceptable according to the purchasing order and Standard Operating Procedure (SOP) to ensure product.

The first step is to check the temperature according to Critical Control Point (CCP) procedure: Frozen products need to be delivered at temperatures of under  $-18^{\circ}\text{C}$ . In the case of convenience, dairy and other pre-packed food items, the control temperature is  $6^{\circ}\text{C}$ . The storage worker is also to frequently check the cleanliness of the delivery vehicle of the vendor, as food item delivery must meet hygienic standards. The storage worker then checks the products in the delivery for their Best Before or expiration dates – old products are rejected and reclaimed afterwards.

Next, the storage worker checks the delivery note whether the delivery contains the right number of items ordered. There can also be the matter of partially or entirely missing materials from deliveries. This information is forwarded to the purchasing assistants, so they can make reclamations or additional purchase orders depending on the severity of the missing material in question.

In the case where the temperature is not met, or the product is not current, the delivery can be rejected, and a reclamation is to be made. In the case of a rejected delivery,

Sales and Production are informed of a possible pause in material availability and possible changes in production sequence as well. This is done in the case there are products partially or entirely missing from the delivery as well.

The receiving assistants then make a reclamation to the vendor and arrange either for a substitute delivery later in the case of a critical product or compensation in the form of a credit note, so the missing product is not billed later. The reclamation process differs with each vendor, as most vendors have an external delivery service and returns should be agreed on beforehand with them.

On a successful delivery check, the storage worker receiving the delivery signs the delivery note, marks down the temperature on delivery and expiry dates on the delivery note. In the case of fresh produce, the delivery date is marked on the products before moving them to storage. As fresh produce ripens at different speeds, it is necessary to separate them by delivery date so First In-First Out can occur.

In the case of specialized deliveries, such as products explicitly marked Halal, the product certification is also checked and documented according to CCP for future reference.

After the delivery has been received, the storage worker delivers the received products to their appointed storage places, which leads to the Product Storage sub-process.

### 3.2.2.3 Product Storage

After a successful product receiving check, the storage worker moves the delivered products to their designated storage areas. These storage areas range from room-temperature for packaging materials and dry goods to a variety of cold storage for dairy, meat and prepared products to freezers for frozen products.

These storage areas have places marked with product names and internal product numbers. These numbers and names are present for both inventory keeping purposes and for quick retrieval in case of production that was not pre-planned and storage workers are not present. This number then ensures that the proper material is used in case there are several products of the same type.

Perishable products are generally placed so they are used in the First In-First Out order to reduce waste due to meeting expiration dates.

Certain production orders require set amounts of product freshness, so despite products being still usable according to their Best Before Date, they may not survive products that are sold past the date. Products close to expiration date may be utilized in the staff restaurant or sold to staff as is. This is done to reduce the waste disposal costs, but also to mitigate the losses from material expiration.

Several storage units are also marked to be specifically for Halal products, which means certain types of products are not allowed to be stored in these units.

#### 3.2.2.4 Distribution of Products to Production Areas

With some products, the Product Storage and Distribution of Product to Production areas processes happen simultaneously. The case for these products may include same-day usage or next-day usage of frozen goods which require thawing beforehand.

In the case of materials used in every day production, the storage workers remove cardboard and wrapping materials from the food materials for both faster deployment and for product safety – due to production area being an area of high hygiene, cardboard is not allowed in production areas. Certain storage units count as production area depending on the products, most often food items that need a storage temperature lower than 6°C. Materials such as cheeses and meats are unpacked immediately, as the bulk cardboard packaging they arrive in is not allowed in production and a cardboard container contains several smaller cases which are easier to handle in production.

In the case of frozen products, the storage worker fills a CCP tag for thawing, containing the product name, number, amount and expiration date. Thawed products are typically expected to be used during the next day, after which they are disposed of accordingly.

Disposal of expired products requires a storage worker to fill the name, product number and the amount of material expired. The reason for disposal is also disclosed: Expiry,

broken packaging during storage or usage in the staff restaurant in cases where the material has not expired but cannot be used in production.

Packaging material disposal is separated into two categories: One for combustible materials and one for cardboard which is recycled. The material handling process generally does not produce unrecyclable waste, as even the biodegradable waste from expired products has been agreed to be sorted from their packaging materials to biodegradable waste before disposal.

Table 6. Weaknesses and Issues encountered in Material Handling interviews.

	<b>Weaknesses / Issues encountered in Material Handling</b>
1	"Material amounts purchased are not always accurate due to changes in production orders and some vendors requiring orders more than 48 hours in advance."
2	"Material usage order not always apparent, as production is primarily in charge of material use and flow."
3	"Inventory amounts in SAP do not match physical inventory, leading to stock-outs or having excess stock that leads to wastage."
4	"Materials not used in FIFO order, leading to wastage."
5	"Excessive old packaging material in storage."
6	"Billing is handled abroad, so delays in payment can cause order stoppage."

As shown in Table 6, most of the problems encountered in material handling are related to the groups dependent on the work done by the department.

After the material has been distributed to production area, the next step in the production process is Production, which contains the assembly, packaging and labelling of the produced items.

### 3.2.2.5 Production

The third stage of the delivery process is the production of the end products themselves. The production process may start from raw materials that are assembled into the end product. Some components may need to be mixed together before ending up as a part of the end product, such as sauces, salad mixes or fillings.

The production process generally follows the Food Safety Practice, which requires the production of food items to follow a strict practice regarding code of dress, sanitation requirements, hygienic practice and temperature control. Below in Figure 5, it is shown how the production process starts partially from the Material Handling Department and finishes as the ready products are transferred to Dispatch.

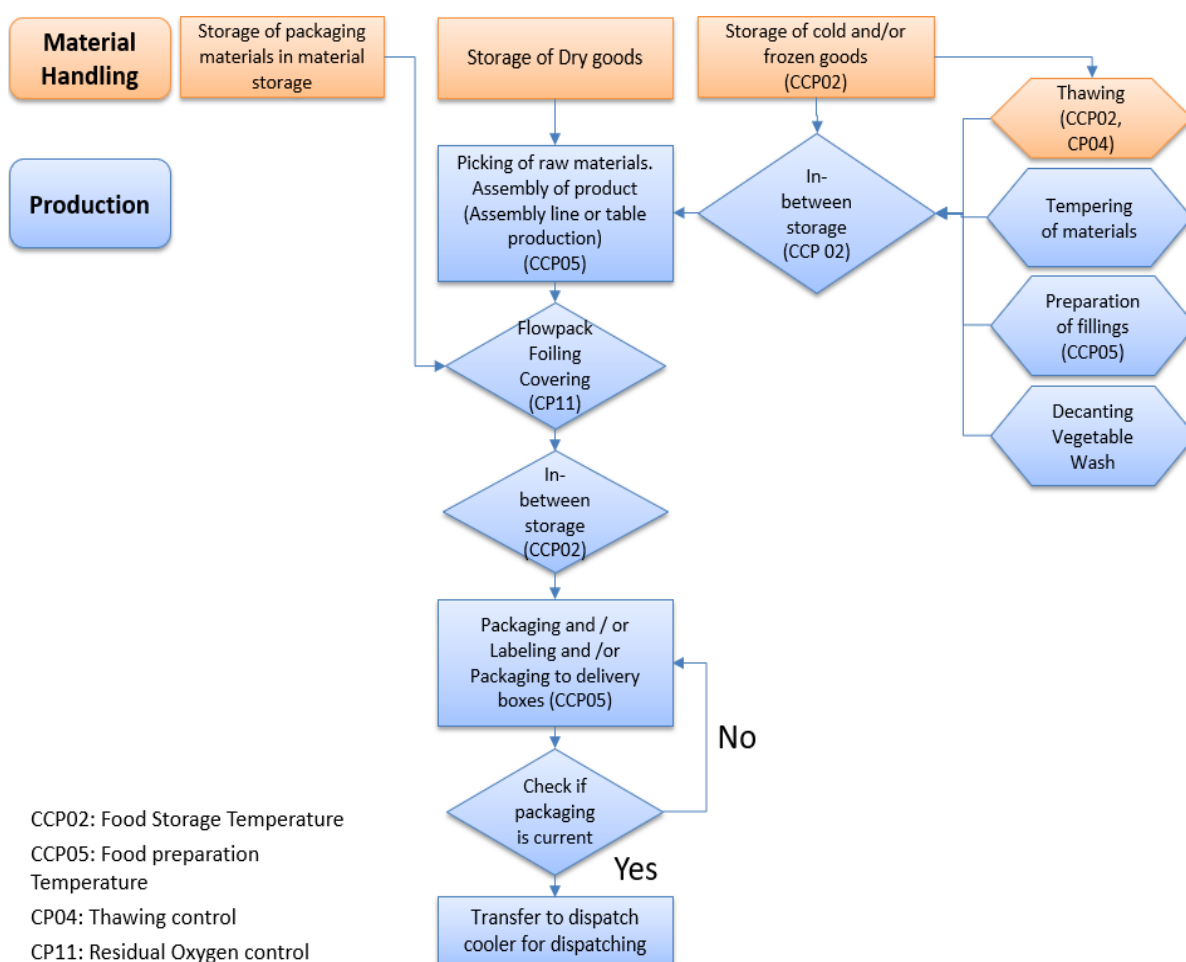


Figure 5. FD 3.04 Generic Production Process Flowchart.

As shown in Figure 5, the production process for a generic takeaway product starts from material handling storing, where the materials are picked according to the production order. Depending on the product in question, the production order itself may be a preparation order for a filling or another element in the completed product.

The order may include thawing of frozen products or tempering of products to a certain temperature before they can be used for the assembled product. In these cases, the production workers fill in CCP02 (Critical Control Point 02: Storage cooler temperature) and CP04 (Control Point 04: Thawing control) forms to ensure the cold chain remains unbroken. In the case of some fresh produce, the process may require the washing of vegetables before they can be used in production.

Once the preparatory process is completed, the materials gathered for a production order are stored in a temporary cooler until production is ready to begin assembly. The assembly of cold products are generally done at a conveyor line or at a table, depending on the complexity and number of products currently being assembled. In the case of the generic takeaway product, the product is assembled at a conveyor line which also leads to the packaging machine.

The assembly process itself requires checks for both material and end product temperature, which are marked down when the assembly starts, finishes and every 30 minutes. This ensures the traceability of possible cold chain breakage. The material batch numbers and dates are also marked down on the production order. Depending on the end product, the materials may require an expiration date of at least 1 + 2 to 9 days. In other words, production date and how many days the product keeps after assembly. These requirements are listed in the product specification.

Depending on the product in question, the ready products may be stored in-between before they are packaged or foiled. The packaging process in general also labels the products with the necessary identification and expiration dates. In the case of products with longer shelf life, the packaged products are also spot checked for residual oxygen (CP11) to ensure the expiration date keeps.

After the packaging is done, the ready packages are checked for any tears or breakages, that the labelling and dates are correct. When this step is finished, the products are ready for dispatching, which is the last step in the delivery process.

Table 7. Weaknesses and Issues encountered in Production interviews.

	<b>Weaknesses / Issues encountered in Production</b>
1	"Deviations from forecast may cause stoppage in production due to materials that require tempering, thawing or preparation of additional fillings missing."
2	"There is no minimum extra order amount regarding previous deviations."
3	"Production workers not aware of material locations when storage workers not present."
4	"It is not always apparent who is responsible for which function, leading to an information shortage at inopportune times."

As shown in Table 7, most of the issues encountered in production regarding the delivery process are related to functions that support the functions done by the department.





picked are then placed on pallets, depending on the customer, either EUR or FIN pallets and wrapped for delivery.

In the case where products are missing, production and sales are informed of the missing amounts. If the production staff can react in a timely manner, the missing products are produced. Depending on the timing of the delivery, the customer is also asked whether it is alright to make two deliveries. In the case where it is not possible, the customer is issued a credit note for the missing products. In the case where it is possible, a partial delivery note is printed, and the missing products are picked, packaged and delivered when they are ready for the agreed delivery time.

In the case where the production is unable to react to the missing products in time, the customer is notified by sales and issues a credit note.

In an optimal scenario, where all products required for picking are found, the dispatcher then reads out the barcodes in the delivery boxes. This inputs the picking list into EDI for order fulfilment and sends a list of the box contents for the system of the customer.

The dispatcher then prints out a cover letter and/or delivery note which lists the contents of the delivery, the temperature on the moment of dispatch and other necessary information. When the delivery transport arrives, it is checked for cleanliness and that the delivery temperature is appropriate for the product type – i.e. refrigerated for cold products, freezer truck for frozen products.

Table 8. Weaknesses and Issues encountered in Dispatch interviews.

Weaknesses/Issues encountered in Dispatch	
1	"Amount of waste from finished products is often excessive. The strict expiration dates don't allow for much flexibility for usage."
2	"In the case of late production, finished products may not meet the required Critical Control Point temperatures, leading to delivery delays."
3	"It is a bit unclear who should be informed of missing products, sales, production planning or production?"

As shown in Table 8, most of the problems encountered in dispatch, are dependent on what happens in functions above it in the process flow. If an order is short of items, they need to make extras which may be very close to the delivery time. If excess amounts of items are produced, they need to be disposed of which costs not only the disposal costs, but the raw materials, packaging and labor costs as well.

### 3.3 Key Findings from the Current State Analysis

In the current state analysis, it was discovered that the main strengths of the current delivery process of the case company are flexibility and final product quality. Production can react relatively fast to changes in production amounts, especially if material handling has been able to respond to possible increases in order amounts to ensure that there are enough raw materials for the product order.

In most cases, a completely new production order can be delivered in 48 hours from the order, provided material vendors can deliver the necessary materials in time. As this is dependent on a vendor-by-vendor basis, it may take 24-72 hours to receive the materials. In critical cases, a local cash and carry vendor can also be used, in which case the material may be ready in an hour, provided it is in stock. High quality of products is assured by the strict food safety control practice and the presence of a QA person in every shift.

Production is also home to several professionals with many years of expertise in the field. Regarding delivery, the company had nearly perfect reliability of delivery of finished production orders despite the encountered issues during the current state analysis phase.



Figure 7, Weaknesses identified in different departments of current delivery process.

Figure 7 shows the main weaknesses encountered in the current state analysis of the current delivery process, which are further described below.

Roles and responsibilities within the process are a bit unclear – production workers are not always sure who to report issues to and some blue-collar workers are uncertain on who is responsible for which functions. As several key personnel have left the company, their responsibilities have been divided to the remaining personnel, some more unevenly than others. Overtime hours have also been frequent due to the lower amount of staff after the reorganization.

Due to relatively late confirmation orders (sometimes received under 12 hours before delivery), the production planning primarily relies on forecasts, which themselves are based on customer orders from previous weeks. The forecasts may end up with significant surplus and cause wastage as the products are mostly specified for following day delivery. The waste is not only for finished products, but for labor and materials as well. Alternatively, the forecast that was planned comes short and require additional production orders in the following work shift. While production can react relatively fast, this may interfere with the original labor and material usage planned for the day, as well as come up missing raw materials for the unforecasted extra production.

Other sources of wastage occur due to the storage facilities being in disarray. This can lead to wastage due to FIFO not being followed, or due to materials left over taking space as older products being removed from rotation. These have been mitigated by selling excess materials to staff when able to. A few years ago, there was an attempt to adopt lean principles to the production process. Reactivating the lean program could be one solution.

Problems with billing and invoicing have caused the purchasing departments orders getting bounced from certain vendors due to credit limits reaching their maximum and bills being overdue. This would not only cause material flow stoppage, but also damages the company credit and credibility in the eyes of the vendors.

Weaknesses 1 and 4 were identified to be problems that are outside the scope of the thesis. They also had a work-in-progress solution on the way or an externally imposed barrier in the way.

Weakness 1 was a result of the recent company reorganization: The problem has been identified and key personnel are currently in progress of being briefed and familiarized on their new duties in the production process, making information flow and decision-making regards problem solving smoother. Overtime issues have been begun to be solved with the reassessment of labor force needed and rehiring of previously laid off staff to keep the necessary expertise required.

Weakness 4 was suggested having to do with a company group-wide policy of centralizing accounting and payment flow to the units in Central Europe. For this weakness, a few practical suggestions were made by the stakeholders. As the weakness lies outside the scope of the conceptual framework, the issue was reported in the initial proposal with the suggestions and feedback given.

This leaves the focus of the study to be weaknesses 2. (Production planning) and 3. (Wasteful practices, storage organization), which are to be discussed in the Conceptual Framework in Section 4.

Weakness 2 in production planning stems from the previous service-based business model of the case company which enabled the production of the company to operate on a make-to-stock basis. Making to stock enabled longer production runs to be push-based, thus being more efficient on material and labor use, with fewer pauses between different products. The stock would then be depleted until a certain point where it would be refilled according to a general forecast from the service customer, thus pushing another round of production into storage. This forecast would be initially made into stock and used until a rotation in products in the service rendered would occur, and the previous rotation stock would be spent from the inventory.

The present, primarily make-to-stock model suffers from the reliance on long forecasts. The forecasts themselves are often executed before the actual customer order that usually arrives only 12-24 hours before delivery.

Weakness 3, the disorganized storage units and wasteful practices also have their roots in the previous service model, which encouraged to keep stocks of material available for large production lots. Some of these materials remain in the storage, not only wasting space, but consume inventory counting time as well. Additionally, as products have been left out of circulation, storage space usage has been noted to be illogical and inefficient

- materials that production can use directly (without the need for tempering or thawing) are in several storage units around facility. This increases the time between production orders due to unnecessary footwork.

The weaknesses found in the current state analysis are summarized further below per function of the delivery process in Figure 8.

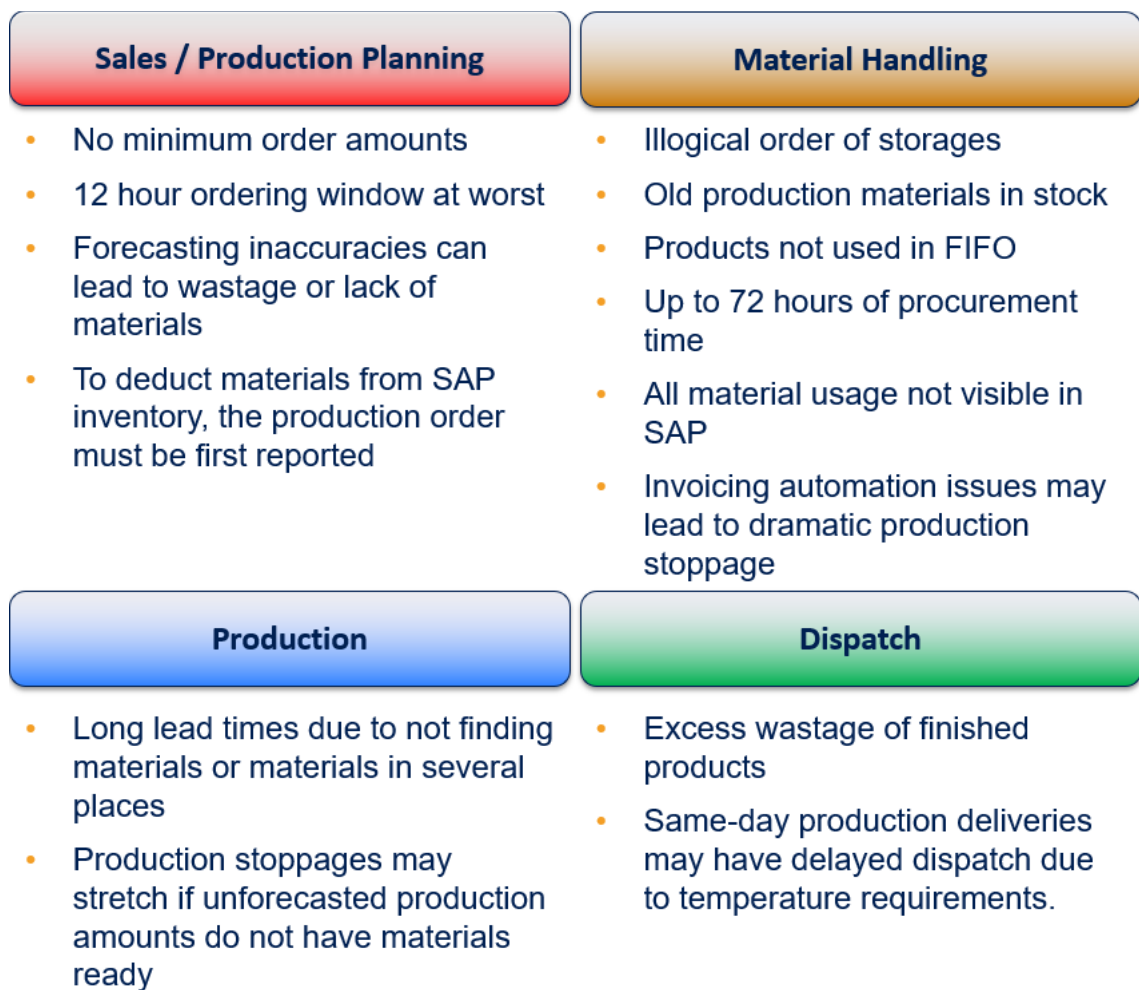


Figure 8. Weaknesses discovered in delivery process per function.

This section of the thesis covered the current state analysis. Based on the issues discovered, they were the focus of the examination of existing knowledge in the field for the development of the conceptual framework. The next section covers the conceptual framework and theory used to build suggestions for the proposal to improve upon the issues in the delivery process.

## **4 Existing Knowledge and Best Practice on Delivery Process Improvement**

This section discusses the existing knowledge and practices on the field regarding process improvement. Due to the wastage and redundant work encountered in Data 1, there was an investigation into suitable forecasting methods and practices. Secondly, due to the production still having elements of the previous service-based business model and them causing redundancies in material storage, a look into lean practices was had. These form the conceptual framework of this thesis and form a theoretical look into how to improve the service level performance (both internal and external) regarding the weaknesses encountered while still maintaining a level of flexibility required for efficient customer response.

### **4.1 Production Forecasting Best Practice**

Accurate planning of supply and demand within a production begins with forecasting. Forecasts are the predictions used for the planning of future events. Planning is the practical process of making decisions on how to best utilize the resources at hand to respond to the forecasted demand. (Krajewski et al. 2010: 484-485)

Krajewski, et al. suggest that forecasts are useful for managing processes and managing supply chains. At the supply chain level, forecasts are needed to coordinate with both customer and supplier. At process level, a forecast of the potential output is needed to design processes and to deal with possible bottlenecks. But before any production can occur, the production needs to be planned in advance to allocate resources both material and labor where they are needed.

Production planning starts with the approach that production takes to deal with customer needs. In the case of a push-based production, it is assumed that the need of products is constant, but the total number required is uncertain, therefore a number of items are produced into stock in advance. In this case, a forecasting of the final number of required items is needed to avoid wastage in the case where demand stops as lead times can be relatively long as well.

In the case of a pull-based production, the customer themselves activates the need for production. In these cases, an agile production would need to have the raw materials ready constantly to produce according to customer needs. It requires a standardized level of production to be able to answer the demand in a short notice.

For example, a buffet or a cafeteria utilizes a push method to deal with patrons ready to eat or take away food in a short notice. In the other direction, a restaurant makes the product the moment a customer makes an order for it. Both pull- and push-based methods can be utilized, especially in cases where one can push a common component into production that has a steady demand that is used to assemble items according to customer orders, i.e., make part of production ready and then make the final assembly according to the defined needs of the customer. (Krajewski et al. 2010: 320)

In the food industry, items that are especially hand-crafted with freshness in mind when choosing the materials, a push method is not suitable for the final production as the customer only pays for what the customer ordered. For items with longer survivability, i.e. frozen products, larger lots could be produced into stock if demand remains, but even these should be considered carefully. A finished product sitting in storage is potential waste if there is no demand.

#### 4.1.1 Efficient Customer Response as a Strategical Choice

Efficient customer response (ECR) is a service-level increasing strategy using cooperation between retailers and manufacturers. It is a strategy especially compiled for processed food industry. The weaknesses of food industry are mainly based on the expiring of both the product and the raw materials. Having an inventory which is decaying at a constant rate makes a make-to-stock approach risky. Having a finished inventory spoil in its storage not only wastes the product that is to be sold to a customer, but also the labor and raw materials used, making it a multiple weakness.

These weaknesses could be mitigated by improving material flow with enhanced communication with each member of the supply chain by minimizing the inventory usage and thus improving cash flow, as inventory and the capital tied into it would remain minimal. Having a constant knowledge of the production amounts also allows for more accurate



labor usage where they are needed. Below, Figure 9 shows the components of the ECR concept.

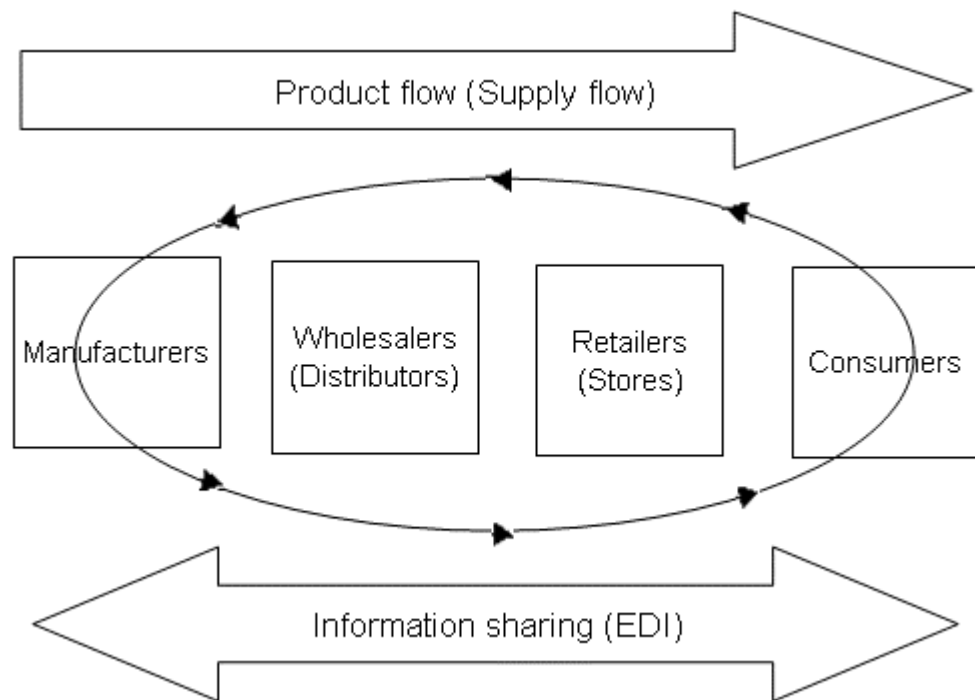


Figure 9. ECR conceptual flowchart.

By minimizing the inventory of a supply chain, production flow can be improved, and cash flow can be made faster. This can be achieved by going from monthly order placements to weekly, even daily order placements as consumer demand is relayed to each segment of the supply chain by EDI. Small-lot deliveries are done frequently to reduce lead times and keep inventories reduced at all parties. (Intrieri, 2004)

ECR has its roots in the original introduction of electronic communication into production facilities. By opening the closed intranet systems to communicate with each other, more efficient cooperation can be gained, as awareness of demand is shared between parties of the supply chain. This enables manufacturers' production forecasting to be more accurate and flexible regarding work distribution. (Finne, Kokkonen 1998: 27-45)

By increasing the communication between the customer and the producer, all members of the supply chain can function and serve their own customers better and more cost-efficiently. The service level can be improved with taking better advantage of sales opportunities, lowered inventory levels and a sharing of customer satisfaction. (Intrieri, 2004)

Establishing a minimum order amount would achieve three goals: First, by knowing the minimum order amount, production handling can react accordingly by assigning the proper amount of labor for each production series. Secondly, a minimum order amount would set the minimum safety stock in the inventory, ensuring that production is always able to produce the minimum order amount. Third, that the customer would always receive a certain number of products regardless of conditions, there would be no second deliveries due to products missing. (Finne, Kokkonen 1998: 27-45)

Production forecasting has a direct effect to both material handling and production: The forecasted production directs purchasing to keep an up-to-date stock of materials required by the production, which uses the stocked materials to make the finished products. The inventory produced is food items, which is challenging to manage, as they are both perishable and have strict shipping conditions regarding temperature.

After forecasting proper material requirements for production, the responsibility to purchase the proper amounts of material and to store them falls to material handling, who are responsible for inventory management.

Inventory can be summed as the stored amount of resources. These resources can include raw materials, information and money. In this case, inventory is used for the materials that flow throughout the supply chain. Inventory management on the other hand is the planning and control of the material that is used in the processes (Slack et al. 2009: 277-302)

Finne & Kokkonen (1998: 49) suggest that implementing an ECR strategy would benefit production planning and by proxy, inventory management. This would be attained by tightening the communication between the production facility and the end customer. As production becomes more aware of monthly to weekly to daily order amounts, it can forecast more accurately the material needed and thus have the exact material, the exact amount at the exact time when needed, reducing inventory keeping costs and keeping lead times short.

The Efficient Customer Response strategy would shift the traditional push-based production method towards a pull-based method, making the customer the ultimate decision maker.

#### 4.1.2 Customer Demand Planning: Forecasting Tools for Make-to-Order

For production planning to forecast production accurately, customer demand must be examined. Customer Demand Planning (CDP) can be a difficult task as the demand for services and goods vary greatly. This demand can vary according to many different patterns. One must take into account seasonal changes (summer, holiday seasons) and trends (health, ecological) while looking at the bigger picture of gradual increase or decrease in cyclical changes over longer periods of time (amount of similar products supplied in the field that affect demand). A fifth pattern exists which is randomness - factors or force majeure that cannot be planned in advance and thus should not be used as a basis for ordering. To make accurate forecasts for CDP, it is imperative to first choose what to forecast and with what kind of a system and technique.

While an estimated demand is required for individual services or goods products, it is efficient to group similar types of goods or services together. This is called aggregation. Common material, processing and labor requirements make forecasting and planning faster and easier for entire product families. The forecasting also needs to be done for individual, specialized goods as well. Forecasting finished goods, or SKUs (Store-keeping Units) is a good unit of measurement, as the monetary value can be derived from the combined value of material, labor and process requirements.

CDP systems have a wide variety of techniques that can be used for forecasting. Due to the variety of production types and situations, no one technique can be singled out as the best. As the objective is to have the best forecast possible from the usable information, it is imperative to use the one most appropriate. Two types of forecasting techniques are generally in use: Judgment and Causal methods. Alternatively, a statistical approach can be used in a Time-series analysis. A time-series analysis uses historical data for forecasting demand, using both trends and seasonal pattern for projecting the demand. (Krajewski et al. 2010: 484-486)

A judgment method uses opinions, expertise and consumer-borne market data to create a quantitative estimate for a forecast. Executive opinions can modify an existing forecast to consider circumstances like promotions or international events. Salesforce expertise can be taken into account for future trends or customer behavior regarding the forecast, however the expertise may be biased on an individual salesperson basis. Market data

research is a direct approach to find out about consumer interest in products by gathering data on habits and interest.

Causal methods are used when data from a longer period of time is available and the information can be used to forecast demand on a historical basis, taking into account seasonal changes and the trends they bring in to the variables that affect the forecast. Linear regression, a mathematical model, can be used. Linear regression takes variables, such as demand which is to be forecasted, and another independent variable that affects this like advertising expenditures, to examine the deviations from the data relating to the independent variables. These independent variables are considered to be the causes to the results observed in the past.

Forecast errors from these methods can be used to pinpoint the better forecasting method. By using the deviations from the actual demand, future forecasts can be made more accurate, to determine the cause of these deviations is another issue.

Statistical criteria can be used to aid in the selection of the forecasting method. If the demand is relatively stable, usage of historical data should be used. For a more dynamic pattern of demand, recent history should be emphasized. It should be recognized that the best method used to predict future demand is not necessarily the best to explain previous occurring demand – past data can deceive, especially if customer demand has been known to fluctuate dramatically. For this, actual demand from recent periods should be used as a testing ground for the predictions and use them accordingly for the approach needed (Krajewski et al. 2010: 486-500)

#### 4.1.3 Inventory Management and Tools

Inventories are the important, everyday element of any organization. As they need to be counted, bought, used in production and used to supply according to customer demand, their management is important. Inventory is a form of investment, taken away from other functions of an organization. As inventory is required to keep more SKUs available to be produced, availability is critical. Too much inventory is a drain on resources and cash flow, while too little represents a threat of no-sell. Effective inventory management is therefore essential to a flexible production organization.

One form of inventory management is to divide the SKUs into different categories according to their monetary usage. This is referred to as ABC analysis, or Selective Inventory Control. In ABC analysis, the items are split into three categories into a Pareto curve where they are divided according to value and amount as show in Figure 10 below.

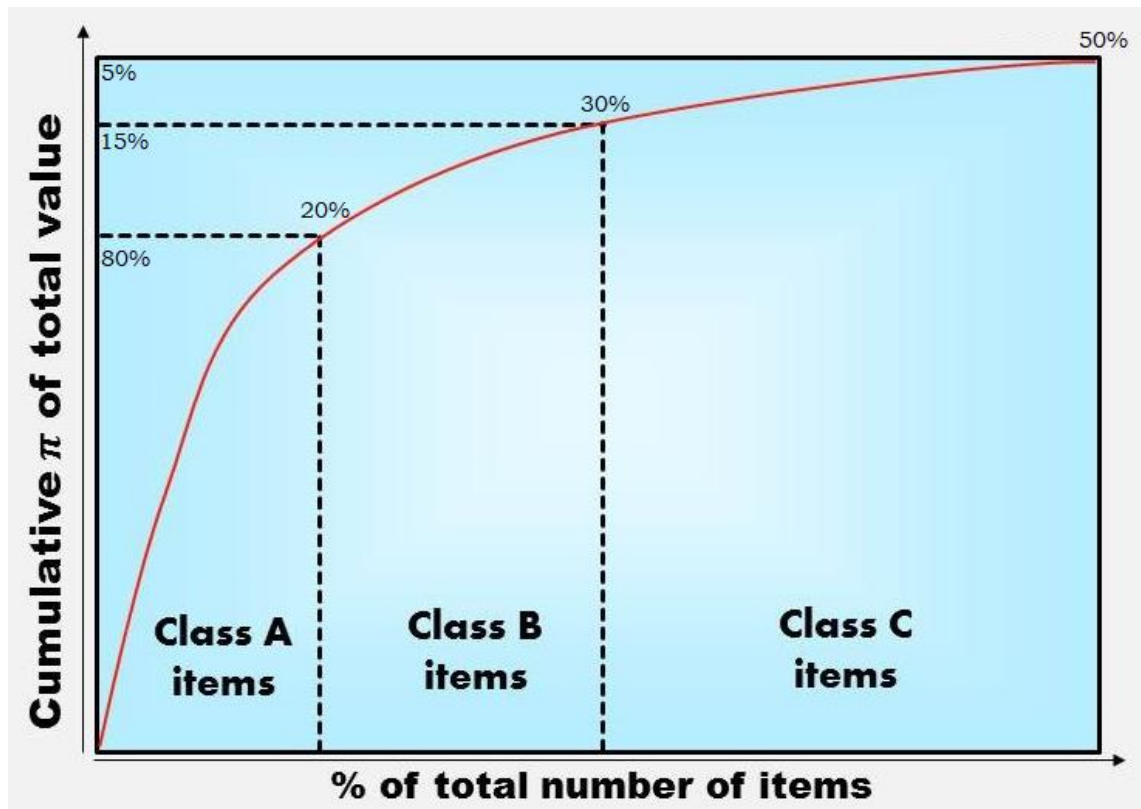


Figure 10. ABC analysis pareto curve.

In category A, 20% of the SKUs are held. These consist of a majority (80%) of the monetary value of the inventory, such as prime raw materials. Category B lists items that consists of third of the SKUs but around 15% of the value, such as common materials to several production items. Category C lists the biggest group of around half the items that have a very small value (5%), such as packaging materials or labels. (Slack et al. 2009: 298-299)

The goal of the ABC analysis is to identify the category A items to properly control their inventory levels: Being expensive and thus critical to keep them at the exact needed amount. Category A items should be reviewed constantly to keep the lot sizes small and to keep the delivery pace steady. A high inventory turnover for category A items is important – to use the expensive material where it is needed, but mostly when it is needed.

By contrast, Category B and C items are less expensive, but still as critical items regarding stock-outs. Due to their lesser value and storekeeping costs, they can be kept in storage at reasonable amounts of safety stock.

Keeping track of inventory manually is also necessary to keep the books accurate. In the case of large inventories with a wide variety of SKUs, a monthly or bimonthly inventory keeping may not be feasible – in these cases, a cycle counting could be considered, where a smaller number of items are counted, and the inventory amount in the ERP is corrected to the physical amount, in case there is a difference. An ABC categorization is next to useless if the inventory numbers cannot be relied on. (Krajewski et al. 2010: 436-437)

For a make-to-order production with uneven demand but constant lead times, a continuous review system is suitable. The continuous review system also known as re-order point system (RPS), is used to track inventory used to manufacture Store Keeping Units (SKUs). Each transaction reviews the remaining stock on whether it is time to reorder or not. It compares the inventory on hand with scheduled production, possible backorders and sets a reorder point on which to make a new purchase order. The reorder point is determined by average demand during the lead time combined with the safety stock. Uncertain demand requires a level of safety stock to prevent lost sales due to stock-out. The RPS can be made more accurate by considering the factor of service level policy and along with it, the lead time demand and safety stock level. By taking these three factors into consideration, the risk of stock-out during lead times can be mitigated. (Krajewski et al. 2010: 442-447)

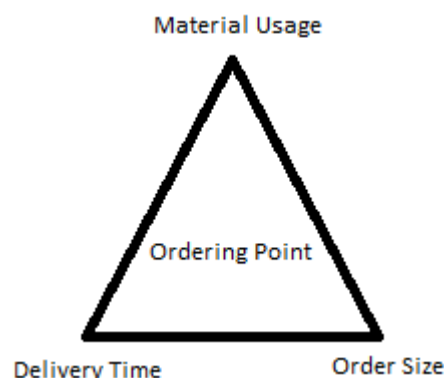


Figure 11. Determining ordering point for material acquisition. (Hokkanen, et al. 2002, p. 205)

Continuous, sustained operations require the proper timing of procurement. In Figure 11, Hokkanen et al.(2002: 204-205) suggest that the appropriate point of ordering is dependent on three factors: The amount of material usage at a given length of time, the lot size of items ordered and the delivery time of an ordered lot of items.

If a production was a make-to-stock type, Economic Order Quantity could be used. EOQ is a tool that helps inventory managing find the optimal point of cycle-inventory level. It balances the cost of inventory holding and ordering cost to always have the optimal amount of material in stock. Each component is assessed independent from others.

EOQ is good for materials that have both a constant demand rate and a constant lead time. Due to the expiration quality of food items and irregular demand, the EOQ is not suitable for day-to-day food item productions. It could be considered for items with a higher survivability that have a longer replenishment period or items that are special-ordered, like packaging materials or brand labels. (Krajewski et al. 2010: 437-438)

In short, by keeping the costly, but money-making material inventory in check, cash flow can be improved, and inventory cost and value of stock can be kept low.

## 4.2 Lean Concepts in Material Handling

Lean thinking is a concept idea founded by the Toyota company in Japan. Lean thinking is characterized by a focus on effort and mindfulness of production surroundings, rather than a set physical or mechanical tools. By focusing on the safety, quality and organization of the production environment, lean production systems could be much more productive than the systems that preceded them. (Bridges, Dualan 2008: 4)

### 4.2.1 Manufacturing under the Lean Concept

Manufacturing under the lean concept consists of many components, both visual and conceptual. What differentiates these tools from many others, is that they are tools of longevity and effort, not mechanical or digital tools. One example of these tools is the visual five-step process (Also known as 5S) which places emphasis on customer needs: Sorting, setting in order, shining/inspecting, standardizing and finally, sustaining.

The customer and their satisfaction with the product are the ultimate goal, which needs the most effort and work towards. This goal of directing effort and work towards only the necessary actions can be attained by identifying wasteful practices, habits or disorder in the work environment. By listening to worker input and examining their methods and materials used, production efficiency, quality and productivity can be increased through a constant cycle of identifying an issue, problem solving and timely implementation. (Bridges, Dualan 2008: 4)

As the problems are solved, they're also reviewed to ensure one solution does not create another problem to keep the cycle sustainable. If a previous solution turns out to be detrimental, it is returned to the drawing board, redesigned and reintroduced according to feedback acquired – they are rarely scrapped outright.

### 4.2.2 Identifying and Eliminating Waste

Improving the process in the first place requires the classification of the activities within a process: What is the part of the process that produces the value to the customer, what is the unavoidable, required non-value-adding part of the process and what is the obvious, non-value-adding, non-required part of the process?



In Figure 12 below, it is suggested that the amount of Value-adding actions should be maximized, while the amount of non-value adding actions should be minimized, if not eliminated completely.

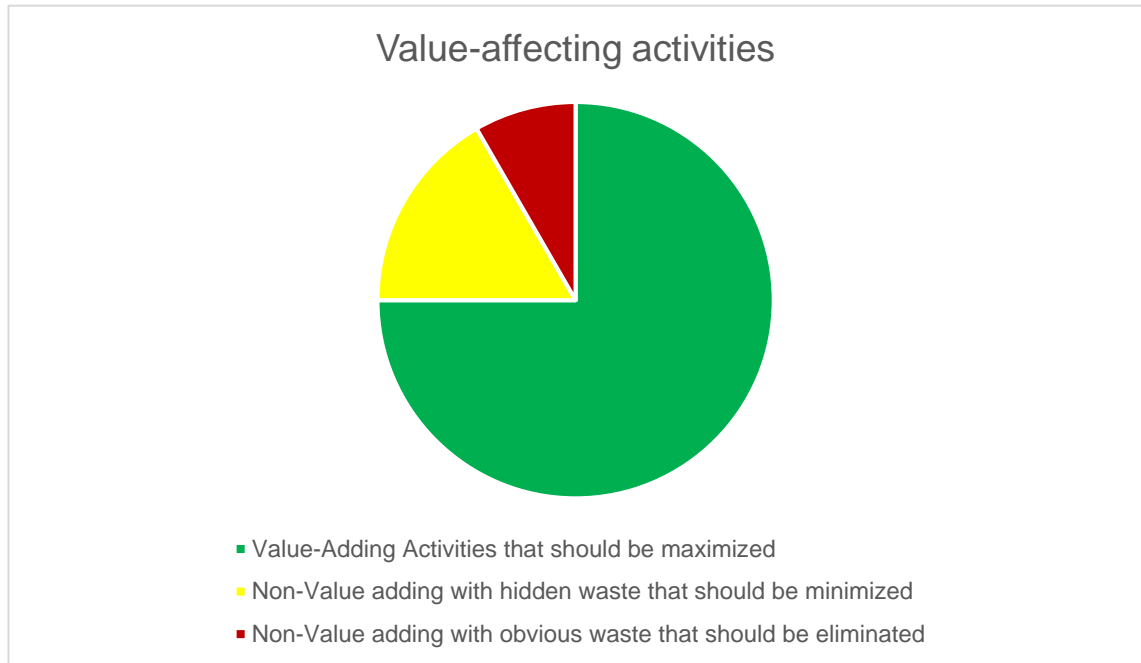


Figure 12. Split between the activities that add and detract from value. (LPS Management, 200X)

Value-adding actions are those the customer is ready to pay for: Producing an item by manufacturing it for a customer, or a service such as delivering a finished product to a customer. These actions are the basis of the business operations that form the company and their impact in the process is the most crucial to upkeep in. It is these actions that should be supported to the best of efforts.

Non-value adding actions are the necessary, unavoidable wastes that are encountered along the way to make the value-adding actions. They are often hidden but can have an impact on the bottom line in the long run. Examples of non-value adding, required actions can be the preparation of work areas for production, processing raw materials for production and storing them before use or quality upkeeping procedures, like making entries into Critical Control Point logs regarding temperatures or time usage. They are the unavoidable, hidden waste part of the process. As this type of necessary waste can only be reduced, the process be optimized for the waste to be as minimal as possible, without influencing the quality, process outcome or other necessary requirements.

Obvious wasteful, non-value adding activities are the non-required, yet a part of the process that does not influence the end product or service itself. This can be a result of negligence or inappropriate working conditions or disarray in general. Examples of waste of this type occurring are wait times from searching for materials in a disorganized storage unit, producing extra inventory when there are no orders for such items or having to re-do a production lot due to an error in the production line. This type of waste should be avoided altogether, with the goal of eliminating such waste from the process. (LPS Management, 200X)

Putting the types of production activities together, the goal is to maximize the value-adding activities in the process chain while minimizing the non-value-adding activities. To improve the process, it is necessary to be able to identify the types of waste that can occur in the process. Altogether, seven main types of waste have been specified, pictured below in Figure 13.

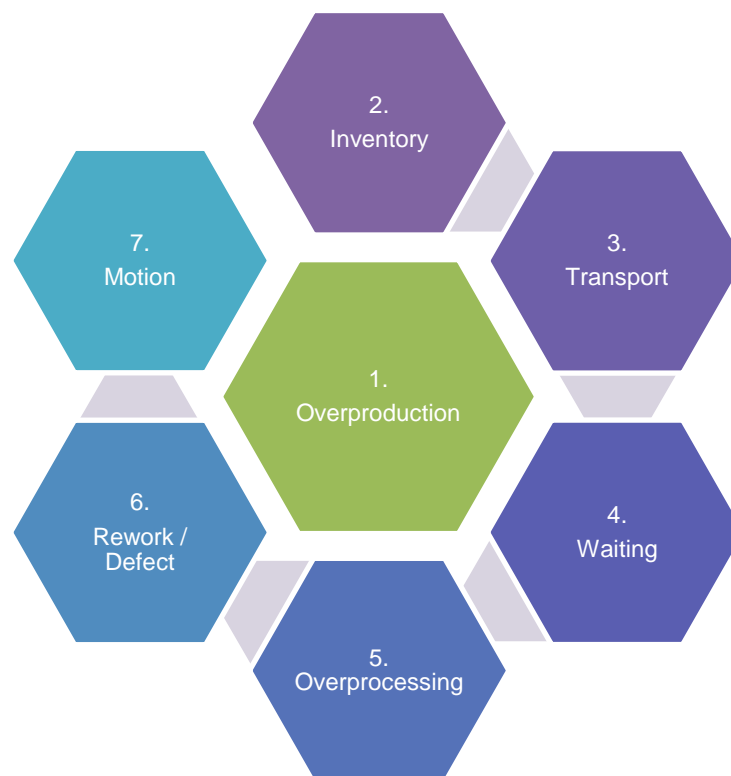


Figure 13. Identifying types of waste.

The first type of waste is overproduction. Manufacturing more products than ordered by the customer. By over-producing, one uses up more materials, space, motion, time (both labor and waiting times) and runs the risk for more defects which require reworking. Overproduction is considered to be the central reason for many other types of waste. Overproduced materials run the risk of not going to proper use and in the worst case, scrapped, losing not only the labor and material costs, but waste disposal as well.

The second type of waste is inventory. By having too much inventory of both raw materials and finished products, the time required to manage the inventory is increased. By having the proper amount of materials, space is saved, and expiration risk is lessened. Having the proper number of finished products means the customer gets what they ordered and production uses the bare minimum of effort required to fulfill the order.

Third type of waste encountered is transporting, both of materials that are used in the process or finished goods. By having to move components and people around, it is a waste of time in both moving material and having to wait for said material. Transportation waste can be experienced if additional deliveries or pickups have to be performed due to missing products or materials.

Waiting is the fourth type of waste. Waiting implies production being held in place due to necessary components, equipment or information. If the production does not have the raw materials to make the products, then production is halted, and the waste of waiting occurs, taking time and labor away from other required production activities as well.

The fifth type of waste identified is over-processing, which refers to excess actions or handling of products in the process that do not add any value to the final product, like excessive flourishes. Over-processing can also manifest itself in having to double-check already checked products or doing additional bookkeeping.

Sixth, defect items and reworking replacements is a type of waste. Having a defect item often means it is either scrapped or reworked from ground up. This leads to having wasted components and labor hours. The reworking also causes additional wait and labor time due to having to plan and execute the remedial follow-up production.

The seventh waste is motion. It is considered to be a physical form of waste in the form of poor ergonomics or work practices. Work should be kept in a small area instead of

having people and material move around. Long distances between components and production can also be considered a part of the motion waste.

Additionally, the waste of talent and the waste of resources are thought to be the eighth type of waste in general - The production staff is the primary asset in the creation of the value in the production facility. By keeping staff content and their talents contributing in the right areas, one keeps the future of the production process bright. The waste of resources can be the usage of electricity and water on top of component usage. These resources are a necessary cost, which should be kept at the level which sustains operations. (Lean Manufacturing 2011)

A lit production in the night with no workers is wasted money and natural resources to produce the electricity. Wasted components not only cost the procurement price, but the fee to scrap and dispose of the trash as well as having to restock those materials more frequently.

#### 4.2.3 Bringing Lean and Continuous Process Improvement to Everyday Practice

To identify the wastes described is one task, the second is to put the learned information into action. To ensure the improvements are put into fruitful action, continuous process improvement is needed. Improvement action is to be performed in a constant cycle: Start by measuring the relevant KPIs, review the daily actions taken, improve as necessary and then sustain the implemented changes. This process is then repeated on a planned cycle to see that the good habits are kept, and the bad ones are dropped out as they appear. To keep the improvements sustainable, the new lean processes need to be nurtured to the production level from ground up. Steps required for this are careful planning to the implementation approach on the theoretical level and training in the form of pilot workshops on the practical level. (LPS Management, 200X: 27-34.)

The first step is to check the environment for readiness – an analysis of current practices and challenges faced by the production. To ensure the future of a sustainable process, it is necessary to mind the present set of circumstances as a base which to work the improvements on.

The second step is to develop and conceptualize the new method of working, starting from the managerial level. A process flow walk can be used to identify the types of waste

encountered or to understand the flow in general. These observations can then be formed into an overview of issues and their impacts on the process flow. These can then be categorized into issues of varying priorities and their financial impacts. As far as cost-saving measures go, the impact of the new model can be tracked by first setting a goal with a target within 6-12 months of implementation and monitoring the results at a monthly rate.

The third step is to arrange pilot workshops to prepare shop floor operators for the implementation of the new model. Basic training and explanation of the current status of operations is important. By having grassroots workers take part in the implementation, the practical impact of the proposed new model of working comes apparent, as they have the most experience regarding the existing working model. The base knowledge can then be supplemented with the new model and first scenarios. As implementation draws close, making the changes apparent with a supply of information is beneficial to prepare the shop floor workers for the upcoming change in pace. When the implementation is put into place, it is important to listen to the feedback and provide stabilizing actions where necessary. (LPS Management, 200X: p 32.)

To ensure the workshops have impact, sustained training and coaching is required. The knowledge from previous implementation should be catalogued and reviewed in future training sessions. By having a systematic approach ensures the sustainability of the working model process improvement. After a process workshop is complete, a trial run is had to document potential issues. As the issues are uncovered and solved, a specification and description are described to create a standard operating procedure. Sustainability is checked via conduction of quality audits based on the Key progress indications of the new working model. (LPS Management, 200X p 34.)

Liker (2008) suggests that most attempts at lean implementation have been superficial due to concentrating too much on the tools without “understanding” lean, requiring a change in organizational day-to-day culture as well. All in all, lean in its core is a mindset, a principle that does not require monetary investment, but effort to make the best of the improvements it offers. A one-time run of dropping improvements on the production facilities is not enough – constant vigilance is required to see the improvements stick. Furthermore, the first iteration is not the ultimate one – the situation may change, requiring a new round of observations, suggestions, iterative action and then seeing what works

and what does not. It is a long-term solution requiring patience and discipline to reap the rewards of a culture of continuous process improvement.

#### 4.3 Conceptual Framework of This Thesis

To encapsulate, the conceptual framework is the combined summary of the best practice in the field found in existing literature. Conceptual framework is the theoretical way to approach problem solving or process improvement. In the scope of this thesis, the conceptual framework is used for the improvement of the current delivery process: Improving the processes that support production without sacrificing the level of flexibility that allows the company to retain its current service level quality.

the company to retain its current service level quality.

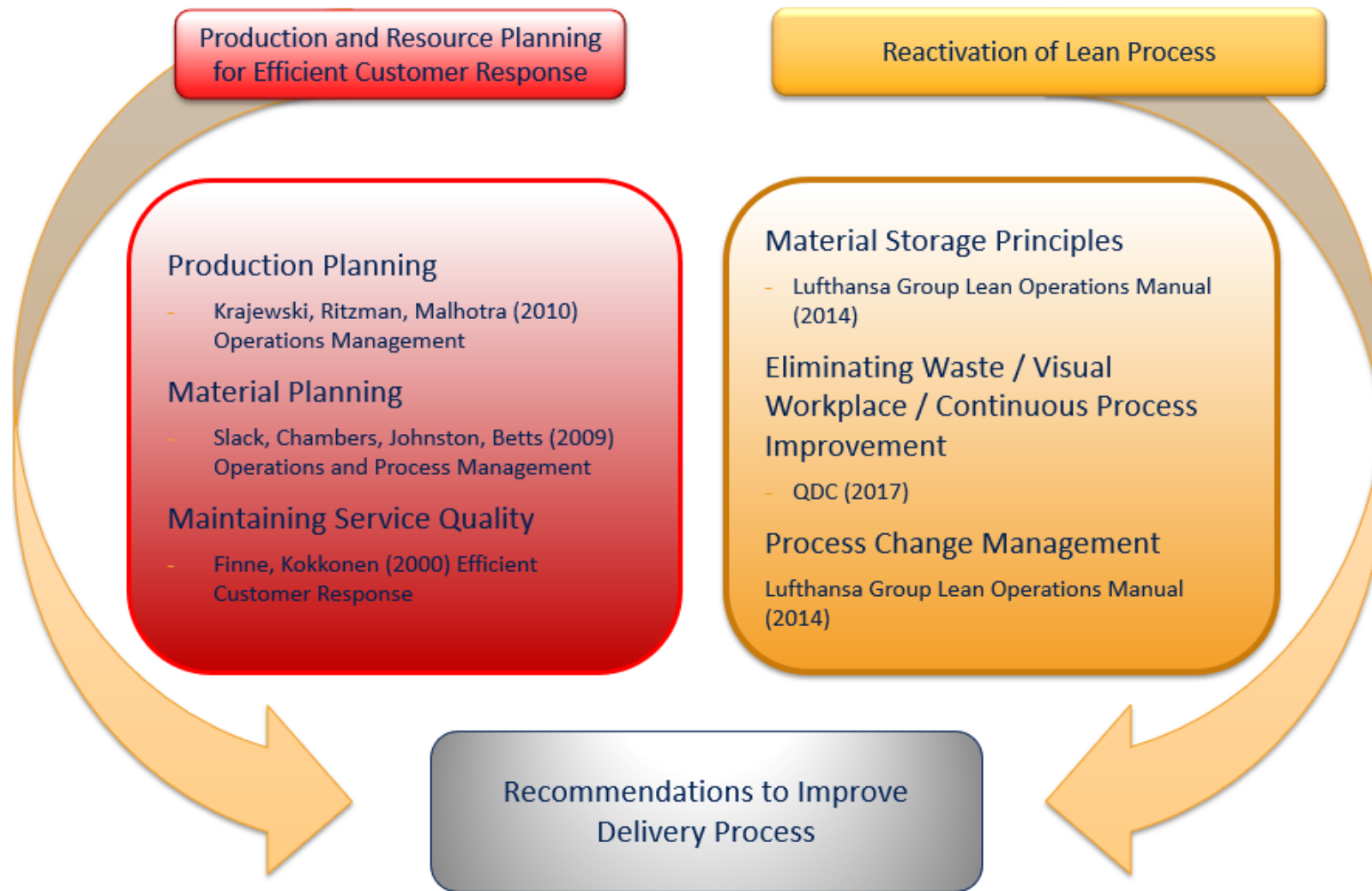


Figure 14. Conceptual Framework for this study.

First, as shown in Figure 14, to remain flexible for Efficient Customer Response, Sales and Production planning must have the necessary numbers ready as soon as possible for material handling to prepare the required raw materials for both acquisition and upon arrival, storage. By aiming to keep as close to the as customer possible, production planning can then enclose the information on materials required to the material handling department. By having a minimum order amount, material handling can then always have at hand a bare minimum safety stock required to make a minimum order amount, ensuring the customer response level remains the same. By categorizing the inventory further by their value and usage, items can be stocked at an optimal level without intervening with cash flow or tying capital to inventory.

Second, to further improve the response time of the production department, bottlenecks in functions that support the production should be minimized. A reorganization of the material storage of the case company is in order. This reorganization would be then executed in the terms of lean concepts – Identification and removal of non-necessary waste by having items in logical places, in a logical order, situated close to the key functions they are most required in. Upon reorganizing, the workspace would also be reviewed to include visual, identifying aid as to which items belong to that part of storage space.

The changes would be planned at a workshop for both shop floor workers and their managers and implemented using their feedback. This reorganization would then be reassessed later to periodically examine whether the new order is efficient considering the current rotation of products at the time. These suggestions to improve the current process are discussed further in Section 5.



## **5 Building Proposal for Improvements to Delivery Process for the Case Company**

This section merges the results of the current state analysis and the conceptual framework towards the building of the proposal using Data 2.

### **5.1 Overview of the Proposal Building Stage**

As discovered in the current state analysis, the issues encountered were situated around the functions that both enable and support production. Production planning forecasting issues affected material handling purchasing decisions, and material handling purchasing decisions and inventory keeping on the other hand affected the flexibility of material handling to react to unforecasted production orders.

To address the production planning forecasting issues, efficient customer response strategy and resource planning were reviewed. These were further augmented with a look into the tools and techniques used in forecasting customer demand.

Issues with material handling were reviewed with a lean reorganization in mind. By identifying weaknesses (i.e. wastes) in the current setup and then tidying them up and making storage more visual, the issues should be mitigated. The relevant information reviewed for the tools and best practice were found in literature.

The proposal was built around the issues found in current state analysis. The stakeholders who were interviewed reported the issues found in their stage of the process. The same stakeholders were further interviewed for their view on initial solutions to the problems as well, considering both their position as being the responsible parties and their expertise regarding the part of the delivery process.

## 5.2 Findings of Data Collection 2 (drawing together Data 1, CFW and Data 2)

The initial proposal was made with the input from the key stakeholders that were interviewed in the current state analysis. These same stakeholders were then interviewed for their opinion on an improvement of the delivery process. The suggestions were then supplemented with elements from the conceptual framework.

Table 9. Issues encountered in Sales and Production Planning and initial suggestions.

	<b><i>Key Issues encountered in CS (from Data 1)</i></b>	<b><i>Suggestions from stakeholders (Data 2)</i></b>	<b><i>Description of the suggestion</i></b>
1	Production planning makes a forecast several weeks ahead of production, but the specified order comes within 12 hours of delivery.	A: More communication with customer on a weekly level where possible - current form of forecasting is basically comparing both last year's average and previous week."	It was suggested that closer communication with customers would be done on a weekly basis to improve both service level and forecasting accuracy.
2	Orders come in from both e-mails and EDI to both sales and production planning, this makes for manual work regarding billing and possible overlap.	A: A streamlined order system where customer orders would come into the system from one source. Naturally, urgent matters could be done via phone and other sources.	Reviewing and streamlining the order process to be identical for all customers was suggested to minimize manual tasks from the process.
3	Customer orders come to both production planning and sales which can lead to confusion.	A: A look into the roles and responsibilities would not hurt since the orders will be tagged 'in process' after they have come into the EDI.	It was suggested to have a look into the roles and responsibilities of both sales and production planning.
4	Most products need at least 24 hours of preparation or material procurement time. If unforecasted, major increases to production order lead times occur. As there is no minimum order amount, small extra orders on day prior to dispatch cause lots of manual work	A: Communication with customer would be a solution here as well. B: As the previous agreements are still valid, so it would need re-negotiation the terms of the contract to set minimum order amounts customer side as well.	A revision of both minimum order amounts and order timing when renegotiating contract terms was suggested to improve efficiency while still upkeeping a flexible level of service.

The issues encountered Sales and Production planning as described in Table 9 were mostly centered around the production planning and forecasting issues. Some customers already had in place either/both minimum order amounts and weekly customer demand forecasts. Those customers had the case company ranked as a high-level or exclusive vendor, providing forecasts and information as requested. These customers generally had low amounts of overproduction and wastage as a result.

On the other hand, customers with a smaller ordering window are very insistent on keeping the current arrangement, as the case company was not a top priority producer and the current flexible system was a selling point, if not the decisive point for them, so making the contract terms less attractive could be counterproductive if not outright terminal.

Table 10. Issues encountered by Material Handling and initial suggestions.

	<b><i>Issues encountered in CS (from Data 1)</i></b>	<b><i>Suggestions from stakeholders (Data 2)</i></b>	<b><i>Description of the suggestion</i></b>
1	Material amounts purchased are not always accurate due to changes in production orders and some vendors requiring orders more than 48 hours in advance.	A: This is a symptom that arises from the fact that the sales forecasts are not always accurate - orders come in 12 hours before delivery. Re-negotiate or ask for more accurate forecasts from customer.	It was suggested that the order window would be widened a little to improve the ability of the purchasing department to react to sudden orders.
2	Material usage order not always apparent, as production is primarily in charge of material use and flow.	A: Production team leaders have brought the list of materials in production a week in advance - perhaps they should make it a daily occurrence instead to make the sequence of production more transparent.	It was suggested that weekly production preparation need slips are shortened to daily needs.
3	Inventory amounts in SAP do not match physical inventory, leading to stock-outs or having excess stock that leads to wastage.	A: The production orders need to be reported manually, which leads the fact that the materials are not subtracted from the inventory until the production order is completed. B: A warehouse control system could work alongside cyclical inventory keeping.	It was suggested that a warehouse control system expansion would be implemented on top of the current SAP ERP system to improve keeping stocks of current inventory. In addition, inventory could be counted between actual inventory days to keep the digital stock more accurate.
4	"Materials not used in FIFO order, leading to wastage."	A: There has been an effort to arrange stock according to the expiration date order, but production still has problems using them in the correct order. B: The other reason is due to production orders themselves requiring materials that need to have a specific expiration date or they cannot be used.	Timely production forecasts would enable more accurate purchases of time-critical raw materials. In addition, improving production orders to have more accurate description of which dates' worth of materials can be used for the production of that day.
5	Old production materials are still found in storage.	A: An investigation into older products and their excess materials is on the way.	Old production packaging material stock is being removed from inventory, but some materials still persist. These are being reviewed.
6	Storage locations can be a bit illogical at times, causing extra footwork to prepare materials for thawing.	A: Arranging storage according to material type or usage would lessen the need to move items around the facility.	Reorganization of materials according to usage to make materials easier to find and to keep inventory.

As seen in Table 10, Material Handling issues were mostly focused around inventory keeping and purchasing decisions, as forecasts are the indirect way of making decisions and MRP executions allow for more accurate purchasing decisions. The issues of inventory keeping stem from the fact that production orders do not subtract materials from stock until they are manually reported after the production order has been completed. Even if every single usage of materials was only sanctioned after receiving a production order, there would still be delay until it was subtracted from the digital inventory, which may cause dramatic differences between the actual physical number and the number in the ERP. A Warehouse Management System expansion for SAP was suggested to better control the flow of items in the warehouse.

Inventory keeping is done once per month for all items in stock. The storage locations for some items are illogical considering their use or type, which makes keeping track of inventory confusing unless one knows the contents of a storage space by heart. One suggestion was to review the storage locations and their contents based on the usage of materials regarding both the direct usage in production and whether they need thawing or further processing. This could be implemented by reactivating lean principles. The delivery process already notably has elements of lean process, but not on a systematic basis. By reactivating lean starting from the processes that support production as a short-term goal, the concept could be reintroduced to the delivery process as a long-term goal rather than trying to fix everything at once.

Some materials from previous products still exist in stock. Materials for food items not in rotation are being used in the personnel restaurant to supplement the menu and to eliminate them from stock. Packaging materials on the other hand are a bit more difficult to utilize, as packaging material is usually customized according to product – deviations from the agreed packaging, especially without warning, would not be well-regarded.

For these additional materials, a waste walk according to the previous lean reactivation would be suggested to closer identify materials that are simply taking space and locking capital without a specific purpose – removing them would also lessen time used to look for materials relevant to production. To further emphasize keeping the value of inventory low, an ABC analysis of materials used would be suggested, as some items are very expensive to keep inactive.

Table 11. Issues / Weaknesses encountered in Production and initial suggestions.

	<b><i>Key Issues encountered in CS (from Data 1)</i></b>	<b><i>Suggestions from stakeholders (Data 2)</i></b>	<b><i>Description of the suggestion</i></b>
1	Deviations from forecast may cause stoppage in production due to materials missing, requiring tempering, thawing or preparation of additional fillings.	A: Implementation of Plan B MO: In case of a stoppage on one production line, there is another with materials ready for production. B: In case deviations are same-day productions, the previous mentioned minimum order amount would restrain very small additions."	It was suggested to both refine the minimum order amounts that would be produced for same-day deliveries, and for dramatic stoppages, another production line would be prepared so workers can seamlessly move to work on another item while the stoppage is being handled.
2	There is no minimum extra order amount regarding previous deviations.	A: A re-negotiation with customer regarding minimum order amounts.	It was suggested to renegotiate minimum extra order amounts to mitigate the effects that stem from the lead times to produce extremely small lots.
3	Production workers not aware of material locations when storage workers not present.	A: There has been an effort to mark down the material contents of storage areas, but it still needs some work. One solution suggested before was a dedicated production runner in each work shift who would gather the required materials."	It was suggested that the storage location contents are further detailed. A runner would then be further briefed on the contents of these storage locations.
4	It is not always apparent who is responsible for which function, leading to an information shortage at inopportune times.	A: A re-evaluation of production process responsibilities is in order, especially after the departure of several key personnel from the company.	The production manager clarified that the production team leaders who were previously in charge of their own functions are being briefed on each current production function.

The issues in production as described in Table 7 are a result of the weaknesses encountered in both production planning and in material handling. Deviations from the forecast when underproduced has an impact on the lead times to produce additional items and an effect on wastage when overproduced. In addition, the storage locations which house items that can be used in production directly have been considered to be located illogically or the items are located in several locations. Naturally, some items require different storage temperatures, are allergens or have other criteria that require them to be stored in a separate location.

For the initial proposal, to reduce the impact that extra same-day orders have on lead times, minimum order amounts would be implemented for products that do not have them yet. In addition, to reduce wastage, it would be proposed that production would stick to the production orders given as each overproduced item has a cost in labor, materials

and packaging, not to mention disposal. The ability to use the personnel restaurant as an outlet for the products is limited at best and it does not return the investment made into producing it.

For the issues that are related to finding materials in storage, both reorganization of the storage locations and reactivation of lean principles one step at a time were suggested. For the short-term, first in order would be the reorganization of the material storages to be more logical regarding similarities in production location and reduce the amount of extra movement needed to gather the materials needed for a production order. Reactivation of lean principles with visual elements for the storage in mind would make for the long-term plan.

To further drive the implementation of improvements, a workshop would be arranged to brief key personnel such as production line runners and those in charge of production of the changes in storage organization and how the improvements are tracked or in the case of detrimental actions, to react accordingly.

Table 12. Issues encountered in Dispatch with suggestions from stakeholders.

	<b><i>Issues encountered in CS (from Data 1)</i></b>	<b><i>Suggestions from stakeholders (Data 2)</i></b>	<b><i>Description of the suggestion</i></b>
1	Amount of waste from finished products is often excessive. The strict expiration dates do not allow for much flexibility for usage.	A: If the entire produced amount could be sent to the customer, it would at least cover possible extra orders on the upcoming days. B: The personnel restaurant uses some products left over, but it is not very efficient as lots of items are still disposed of. C: There should be little if no extra produced past the amount in the production order slips.	It was agreed that it should be communicated to production that they should only assemble the number of items specified in the production orders to produce only the amounts in the picking orders – any excess items from the dispatch cooler are being used in the personnel restaurant, but reducing the extras produced should be the goal.
2	In the case of late production, finished products may not meet the required Critical Control Point temperatures, leading to delivery delays.	A: If it were possible to get the proper amounts into production earlier to production via communication with customer, this would not be an issue. B: Alternatively, specify minimum order amounts that would need to be fulfilled for production to react.	It was suggested that same-day orders under a certain value should be discarded – a minimum production amount should be imposed on products, depending on customer importance.

The issues in dispatch, as described in Table 12 are centered around same-day deliveries stemming from forecasts that came short and from excess production. The service level review would enable to make better decisions regarding same-day orders of certain

sizes. The wastage incurred from excess products should be investigated as well to find out the reason for the overproduction.

Table 13. Other issues outside of focus areas with suggestions

1	Invoice payment is handled abroad, so delays in payment can cause order stoppage.	<p>A: A locally sourced accountant would make issues with billing solved much faster.</p> <p>B: The issues with automated payments have been more prevalent so an investigation into the matter would be in order.</p>	One suggestion given was to have a locally situated accountant to take care of invoicing and billing manually in cases where the automation has caused payment stoppage. Furthermore, the issues have been almost a monthly occurrence, so an investigation into the matter should be done.
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The invoicing system as described in Table 13, has had some issues. Some discussions were had, and suggestions were given: One was to have a locally situated accountant take care of these issues to get them solved. This would be an investment into a whole new staff member which would also mean the issue itself would remain and it would need to be solved every time it occurred. The second one was to have a thorough investigation into the automated payment issue as the problem has been more prevalent and the possible damage to both reputation and credit rating could have serious ramifications for future.

The suggestions that were made are summarized below in Figure 15 according to the delivery process stage.

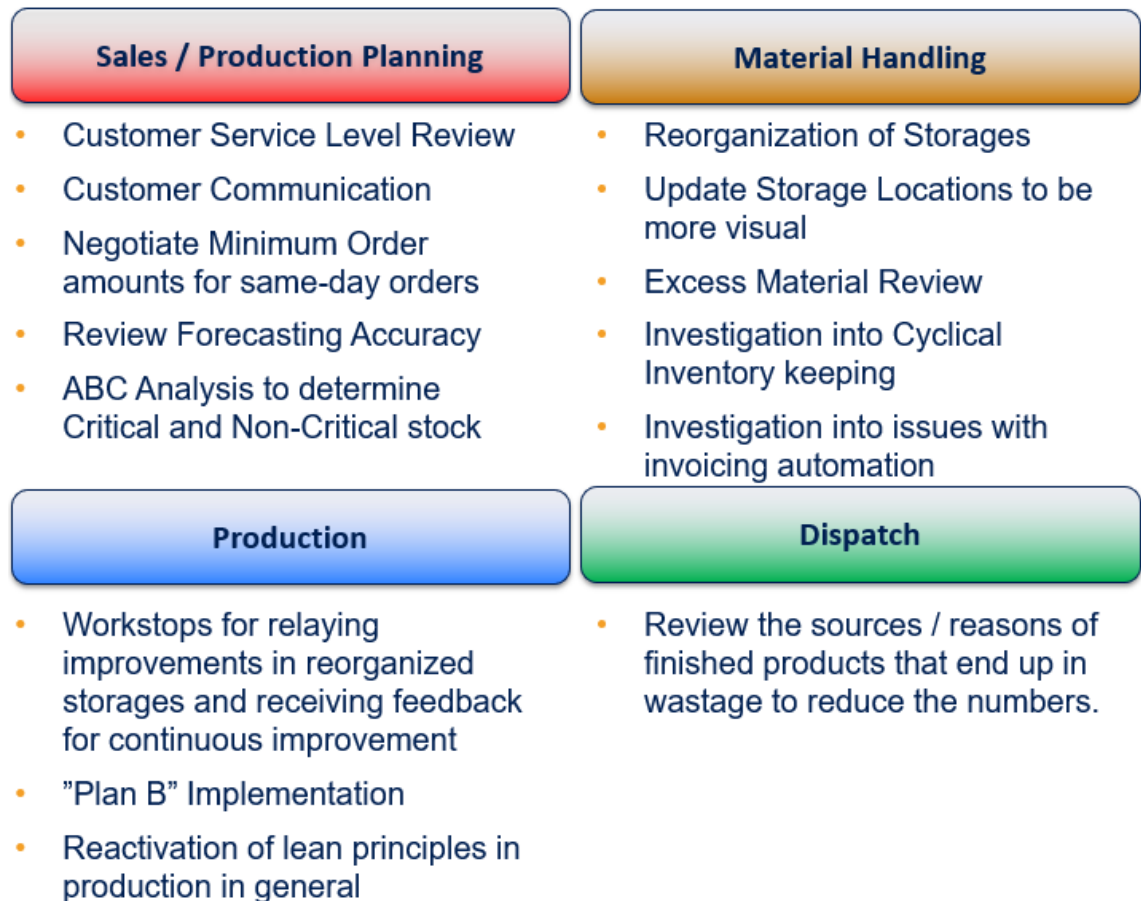


Figure 15. Suggestions per delivery process stage.

### 5.3 First Element of Proposal – Production Planning

For the first element of the proposal, several proposals are made with the intention of improving the production planning section of the delivery process.

First, a review of the customer service levels of the company is proposed. The service levels would be determined by the production amounts, the order production timing vs delivery timing and the level of communication extended from the customer regarding. Customers with high level of communications regarding order amounts can be served better in a long-term basis due to the virtue of having the relevant information at hand when required to plan both production and material purchases. For customers with less communication regarding amounts and short order windows, more effort is needed to make the planning and purchasing sufficient and on-time and so these customers would also be negotiated with to secure a better window of operations with.



Second, existing customer product specifications on contract would be examined. The product specifications would be reviewed to find possible ways to consolidate the materials used for several products of similar kinds to both reduce the amount of different raw materials in current use and to centralize purchases to fewer vendors. The materials on these products would be further categorized using ABC analysis to determine a reasonable safety stock for critical but expensive products and to keep other, general, non-perishable products at feasible levels. This can further be backed by the improvements suggested in the second element of the proposal, in reorganizing the material storage units to be more visual and utilizing the Kanban method of determining product pull and restocking.

The ultimate goal production planning-wise would be to reduce the amount of reliance on long-term forecasting and increase the amount of accurate, short term forecasting by closer communication with customers to better understand and meet customer demand. Accurate production planning also aids procurement by reducing the risk of stock-outs. Having accurate forecasts on a daily level rather than weekly would also reduce the wastage of time-critical raw material due to spoilage. This has been an issue with products that are ordered on daily basis, fresh produce and dairy products being an example.

#### 5.4 Second Element of Proposal – Lean reactivation and Material Handling

For the second element of the proposal, it is suggested that the company reactivates the Lean process concepts for its functions. The current delivery process contains elements of a visual, lean process, but the execution is rather limited. There is a lack of company-wide adoption of a lean-driven culture in the delivery process. It is then proposed that by starting with the processes that support production (i.e. material handling and preparation), the process could be introduced to the remaining functions of the delivery process much easier, as the benefits would start trickling down the delivery process flow. By proving the benefits from a partial adoption of the lean processes first, the rest of the staff should be easier to convince of the benefits of expanding the process to their functions.

As a part of the second proposal, the current storeroom arrangement would be reviewed and rearranged according to a lean philosophy – identify wastes in the current arrangement and plan rearrangement accordingly. Current weaknesses are the storage of common everyday materials in several storerooms requiring a lot of extraneous movement to gather for one production lot. In addition, the storage units have excess materials from older, finished productions not only tying capital, but space as well.

By rearranging the materials in a logical manner, this unnecessary movement or wasteful practice could be reduced. In addition, the rearrangement would be made while updating the storeroom stock lists according to previous inventory count to ensure the content of the list stays accurate. This would further support production by making the materials easier to find and by reducing lead times between production lots due to less movement and time spent finding the correct materials.

By removing the excess materials from rotation, there would not only be more space, but the inventory would not contain anything that would not currently be in value-creating use. Finally, the reorganization would include making the storage more visual, with product places being accompanied by both name and SAP number, ensuring that similarly named products are not mistaken for each other.

For the implementation of these improvements to success, workshops would be held for the key personnel in the process functions. These workshops would first introduce the initial reorganization plan and then the plan would be adjusted according to feedback. As the personnel then returns to their function in the process, they relate the changes to their peers who provide further feedback from a practical perspective. The reorganization is then reviewed in time to see if the changes have had an impact in the delivery process.

## 5.5 Proposal Draft

Sales and production planning have the most impact on the functions that occur after their part in the current delivery process. After production assembled the items from the materials purchased by material handling, production planning reports the finished production orders and in effect, finally deducts the used materials from the ERP stock.

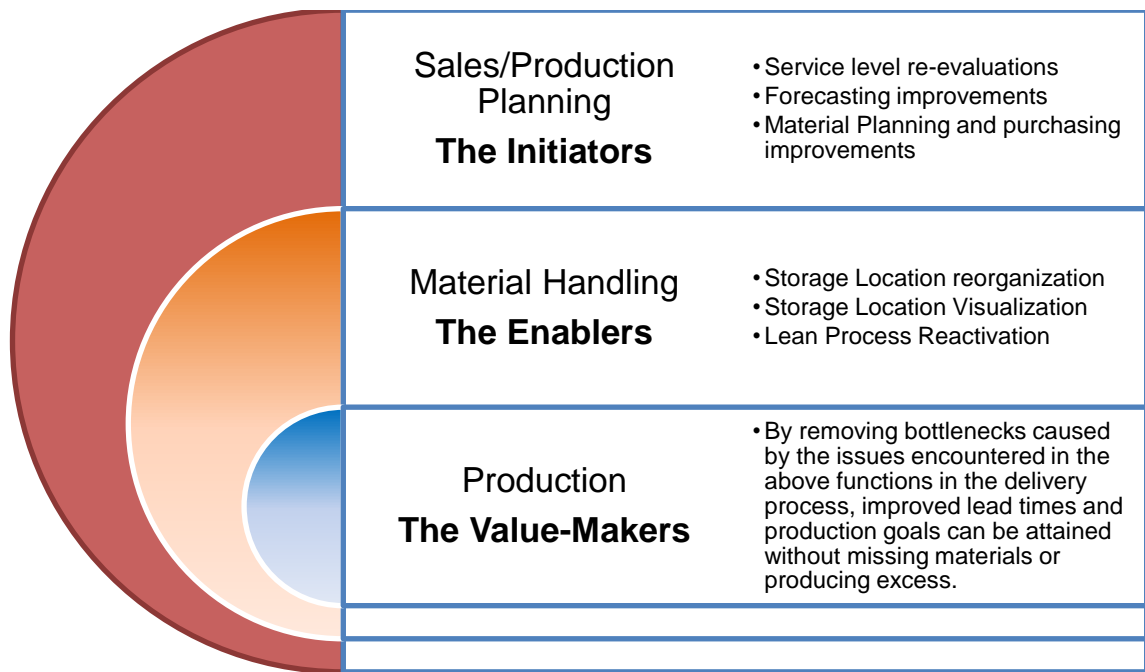


Figure 16: Proposal Draft Improvement blanket effect.

As seen in Figure 16, the effects of issues and improvements trickle down into the next level of the delivery process. As production is the primary value creating department in the delivery process, it is imperative that the effects of the bottlenecks that occur in the functions above that support it are reduced. By determining the service levels of customers, production planning can be prioritized accordingly. This in turn helps to communicate forecasting to production planning depending on the level of customer co-operation.

When production planning and customer demand forecasts are made more accurate, material planning and purchasing decisions can be made more efficiently as a direct result – in the case of rarely used, expensive materials, the ABC analysis could be used to determine the stocking levels and whether a material buffer is needed. In addition, review the accuracy of made forecasts vs the actual customer orders for a period. This assists both in making more accurate future forecasts and material planning to determine buffers for materials that are in frequent use.

By maintaining a stock according to the production forecasts, material handling is able to utilize the existing material storage locations more efficiently while keeping the value of the inventory on hand low. Capital tied into unused stock is wasted resources in both space and money. The reorganizing of the storage locations would also reduce time spent gathering materials for production and reduce the lead times between productions.

For unforeseen stoppages in production, the implementation of a “Plan B”-model is proposed. Production already has a runner who gathers materials ready for next production – this runner also prepares assembly lines. If the issues in production can be communicated effectively, the effect of stoppages can be mitigated. Furthermore, wastage should be paid attention to. Dispatch ends up having most of the excess products by the end of day and the reasons for the overproduction that occurs should be reviewed to reduce the amount of wastage to save on both materials and labor costs.

To communicate the proposed and implemented changes into functions in the delivery process, workshops for key personnel would be held to both brief the changes made into the current organization of materials and to receive feedback accordingly. The workshop participants would then communicate the changes to their own teams and get the information widespread in the organization. These workshops could also be used to introduce lean concepts back into production one process at a time at a later date, once the initial improvement implementations are in motion.

To summarize, the previously proposed improvements are further visualized in Figure 17, Proposals per implementation area.

After the proposal, in the following section of the thesis, the proposal draft and the suggested improvements are presented to the company key stakeholders and decision makers for feedback and validation for the final proposal.



Figure 17. Proposal implementations per area.

## 6 Validation of the Proposal

This section reports the feedback from the initial proposal presented in Section 5 and the validation received accordingly. This feedback is then used to form the final proposal and to define the following steps taken to plan the next actions in the form of recommendations and a roadmap.

### 6.1 Overview of the Validation Stage

The proposal draft was created together with the key stakeholders of the delivery process. The proposal was based on the results from the current state analysis and the conceptual framework. The purpose of the current state analysis was to identify weaknesses or issues in the current delivery process. The conceptual framework was used to build a theoretical base for the suggestions for improving the delivery process. Finally, the key stakeholders were consulted on the suggestions and their feedback was used for validation purposes.

The validation of the proposal was done in two steps: First, the key stakeholders were given a presentation of the recommended actions taken to improve the delivery process with an initial schedule of the timing of the improvements. Second, face-to-face discussions were had with the decision makers regarding the suggestions to find out possible limits on implementations and to adjust the scope of the implementations where necessary. The stakeholders were given a full list of the issues and the initially suggested improvements and encouraged to give both criticism and further improvement ideas to develop the proposal further.

### 6.2 Findings of the Validation Stage (Data 3)

The feedback received from the stakeholders was overall positive with a few suggestions to adjust the implementation scope and with a few possible future developments as well. As majority of the issues and suggestions were around functions that support production, a few comments into considering improving the processes within production itself were given. The feedback comments are described in Table 14 below.

Table 14. Stakeholder feedback.

Informant/Stakeholder Group	Feedback given
Production Planning A	“The waste walk for removing old materials and ABC Analysis would assist in inventory keeping very much as there would be less to account for.”
Production Planning B	“It is an impressive amount of research into matters that have been around for a long time, but finally they were brought up in a more concrete manner, hopefully they can now get the attention they require.”
Production Planning C	“From our point of view, we liked the fact that the present issues in production are handled realistically without resorting to radical, major change-requiring solutions that wouldn’t be realistic to attempt without losing revenue – or in the worst case, customers.”
Production Manager	“Good job! The proposal seems to be pushing the entire delivery process supply chain to be a lean entity. I would have liked to see more concretely defined actions regarding the reactivation of lean concepts in production.”
Project Planner	“Overall, I agree with the suggested improvements. Shortening lead times would bring extra flexibility regarding material usage and unifying the ordering process for each customer would be a good target to have.”
Senior Project Manager	“As the company is going towards a new business concept, the suggestions are a step towards the right direction. Perhaps after the initial round of improvements are done, a new warehousing concept could be considered?”
Company Managing Director	“The work done here is thorough! It would be important to underline the value of the procedures implemented - I’d just add a few words to help the more monetary driven decision makers to understand the project perspective.”

As seen from Table 14, the stakeholders were mostly content with the suggestions made to improve the delivery process. The recommendations were seen as being manageable from the perspective where no significant monetary investments would be made, and a completely new process could be radical to a point where it could cost revenue, customers or even the progress made so far with the shift to the retail-based business mode. As the scope was to improve the delivery process regarding moving from a service-based business model to a retail-based one, most of the issues and weaknesses were from production and material planning in general, but the production processes could be a valuable topic to explore in the future.

While no additional development suggestion arose from the proposal presentation, some topics were requested to be specified for the managerial, monetary driven decisions. For this, a review of the wastage of the first two months of the year was made and a generic takeaway product was used as an average when it came to material, labor and overhead costs, described in the next section.

### 6.3 Developments to Proposal Based on Findings of Data Collection 3

The proposal received feedback regarding the financial impact of the recommended actions. From the budgetary point of view, the managing director requested examples of investment required vs the return from the investment.

The proposed actions in the material handling department were about changing the layout and the way of working instead of making a direct investment into a physical tool or materials. The improvements of reorganization of the storage units would be qualitative. These changes would require continuous review and possible adjustments afterwards, if the various agents in the delivery process consider any of the changes detrimental to the daily functions. The effects, both beneficial and detrimental, could be tracked by requesting direct feedback from the operators taking part in the delivery process or by devising specific KPIs for the improvements.

The intended effect for the reorganization was to a) relocate the items closer to the intended utilization location for faster retrieval b) organize materials according to usage type such as items used for fillings or bakery products while taking into consideration



allergens or other dietary restrictions as well c) make the items easier to keep book of during inventory via the previous logic.

Regarding the improvements suggested for reviewing the forecasting methods and reducing the wastage, the first three months of wastage were reviewed to be used as an example. In the example, an average of 50 pcs of finished items were disposed of daily. By taking the average of takeaway products from the list of produced items, the material costs of the item would be 0,60€ per item, the labor costs would be 0,60€ per item and the overhead cost would be 33%. In this case, the generic takeaway product would cost 1,8€ per unit to product. If the same average trend of 50 pcs of wastage per day would occur for the rest of the year, the costs would rise accordingly, as described below in Table 15.

Table 15. Average cost of Wastage per period based on first quarter numbers.

Day	Week	Month	Year
93,6€	655,2€	2808€	34,164€

By reviewing the root causes of wastage of finished products, the costs brought by the wastage could be reduced significantly. Naturally, the costs of the various items in production would differ per item, making it extra compelling to reduce the costs on the especially expensive ones. This would make for an argument for the implementation of the ABC analysis as well. This would have positive effects on raw material and packaging material consumption as well as the ordering frequency for those items to reduce delivery costs.

In addition, consolidation of both raw materials and vendors were suggested to be taken into consideration after the initial proposal was submitted. Using a single vendor rather than several would be savings in delivery costs. Several raw materials of the same type (produce, in both frozen and fresh forms) exist in the production item portfolio as well – consolidation of these materials into fewer SKUs would also help in unifying the production order recipes and product portfolio. Naturally, would also be dependent on the product specifications tailored to each customer – changes to the specification would require their consent as well.

## 6.4 Final Proposal

The objective of the thesis was to make recommendations to improve the current delivery process after the shift from a service-based business model to a retail-based one. The proposition includes recommendations that would improve the weaknesses in the delivery process starting from the initial order forecasting in sales and production planning to material planning to production and to dispatch.

By improving the forecasting more accurate material purchases for day-to-day production can be made, which in turn ensures production always has the amount of materials they need to make the exact number of products the customer has ordered. This in turn assists in keeping wastage of finished products down as well as keeping material usage as per the planned production, not the excess production. The suggested improvements in the production planning department would affect the entire process below it, with each improvement benefitting a function below it.

In addition, the improvements suggested to reorganizing the storage units to a more logical, visual order would make the retrieval of material faster, easier, keeping books of the physical inventory and keep excess, unneeded material away from the active materials. An implementation of KPIs to keep track of the improvements was also suggested. The most logical choices would be the wastage of raw materials, production stoppage due to lack of materials and the number of ad-hoc, expedited orders. For the previously listed KPIs, reasons for them should also be listed to explain the context they occur in.

Finally, an investigation into reviewing customer service levels was suggested. Factors to consider for the various levels would be the volume of items ordered, minimum order amounts, communication of demand in advance, order frequency and timing of delivery vs time order received.

## 6.5 Initial Action Plan

As the initial implementation of the storage reorganization requires change in the way everyday work is done, they are relatively easy to implement in the sense that there are no budgetary constraints or a need to build a new system from scratch.

In Table 16, a tentative roadmap for the proposed implementations is illustrated. To begin, the first step would be doing the storage reorganization - as materials are moved locations closer to their usage points, production can benefit from the change as soon as the information about the new storage locations is relayed to key personnel. The initial action plan represented here is made with a proposed half-year plan in mind. The final schedule is wholly dependent on whether the improvements are implemented, partially implemented or not implemented at all.

Table 16. Suggested Implementation Roadmap.

Improvement	May	Jun	Jul	Aug	Sep	Oct
Storage Reorganization						
Waste Walks / Excess Material Cleanup						
Reorganization Workshop						
Reorganization Review						
Material ABC Analysis						

As the material is being moved around, a round of inventory keeping between months is inevitable. By taking note of the material out of rotation or completely out of production, the excess material waste walk can be initialized and a plan to dispose of the excess materials can be made. Around the same time, the changes in the storage order so far could be made known via a reorganization workshop or a training session. Future inventory keeping sessions could be accompanied by the material cleanup process as well.

The following section summarizes the thesis and discusses the managerial implications.

## 7 Conclusions

This section acts as a summary for the thesis and describes the managerial implications of the thesis. Additionally, the thesis is evaluated based on the initial objective versus the outcome.

### 7.1 Executive Summary

The objective of this thesis was to improve the delivery process of the case company. The original business challenge rose due to a switch from a service-based business model to a retail-based one. In effect, this caused the production type to switch from a make-to-stock to a make-to-order type, which in turn makes the production planning aspect important regarding forecasting customer demand and material planning. Excess production would lead to wastage of materials and labor, coming up too short would cause smaller lots of extra production on the delivery date. As is the case with the food industry, expiry dates on both finished products and raw materials give their own challenges regarding order lot sizes and timing.

The thesis explored the weaknesses and issues of the delivery process via current state analysis. The current state analysis was conducted by reviewing the various functions in the delivery process. First the processes were run through step by step by consulting the internal process flow charts of the company. The processes were then reviewed with the stakeholders in those functions and identifying the weaknesses and issues encountered in those functions. As a part of this step, the stakeholders also gave their own suggestions for initial solutions to these issues.

The issues discovered were roughly divided into two major groups: Issues regarding production planning and issues with the warehouse storage organization. As the business model shifted to a retail-based one, the company strategy should also mirror it. As a result, research was placed into Efficient Customer Response (ECR). ECR highlights the power of the customer as the main pulling force behind decisions regarding production. In addition, as the storages were considered to be organized in an illogical manner and several years' worth of old materials were still found, a look into reactivating previously introduced lean concepts was had. As a joint result of the initial views from the

stakeholders and the theory explored in the conceptual frame work, several suggestions were made to improve the delivery process.

The first section of the proposal included suggestions for Sales and Production planning, which are the first steps in the delivery process, as they act as the initiators of the delivery process. Suggestions included reviewing the accuracy of forecasting and the root causes for wastage of finished products. The results would help not only adjust the forecasting to be more accurate in the future, but by finding the root causes behind wastage of finished products, savings in material, labor and disposal costs could be gained as well. To aid with material planning, a proposal to look into ABC analysis was made as well. The second section of the proposal included recommendations to the reorganization of the storage department of the company.

As the storage units were disorganized, production staff had difficulties finding items and items were often used in a non-FIFO order, the problem was approached with a lean solution: To make the storage units more logical regarding material usage type, closer to the functions utilizing the materials and removing materials no longer in rotation. To further make the changes more apparent, the storages would be updated to be more visual to assist in both finding the materials and keeping inventory count. Furthermore, the changes in storage contents would be reviewed each month during inventory, updating the visuals in each storage unit.

The suggestions in the first proposal to improve the delivery process were received mostly positively. One challenge for the proposals were their monetary impact, both investment and return-wise. Due to the suggestions' non-dramatic impact on everyday operations, the investment into the proposed suggestions would be to gradually weave them into the daily functions. As the recommendations were not investments into entirely new systems or tools, the investment monetarily would be the amount of additional effort put into the implementations alongside daily functions and gradually changing the way people worked.

As for the returns, the improvements closer to the beginning of the delivery process have the most effects considering the beneficial effects trickle down into the next functions - more accurate forecasting leads to more efficient material planning and purchases. This in turn ensures production has the necessary materials when needed, without excess production. The overproduction mitigation leads to the reduction of wastage of finished

products, which also reduces material and labor costs which are a part of assembling those products.

In conclusion, the recommendations to improve the delivery process are small independently. The higher in the process the improvements are implemented, the more compounded their effects are in the rest of the delivery process. With a more customer demand-oriented strategy, the company is prepared to take on the challenges of the retail sector with renewed vigor.

## 7.2 Managerial Implications and Recommendations for Next Steps

While an action plan for an initial implementation of improvements in material handling was given in Section 6.5, some of the recommendations in the functions that reside higher up in the delivery process would require further managerial consideration before committing, such as those that deal with customer service or communication.

For the proposed changes to be implemented in an efficient manner, there should be a look back into what works - the strengths of the case company in the delivery process included flexibility, delivery reliability and the decades of experience of the production staff in producing high-quality takeaway products. While the suggestions and their implementations are not dramatic, groundbreaking actions, it should be carefully previewed whether the changes would jeopardize any of the previously mentioned strengths.

While the recommendations' proposed effects higher up in the delivery process have compounded effects when going down the process flow, reaching too many changes simultaneously may not end as intended. As such, the proposed actions closer to production would be prudent to be implemented first to ensure the next actions have a better chance to succeed. While sales and production planning act as a bottleneck for material handling to do purchasing, material handling itself acts as a bottleneck for production to receive the materials necessary to initiate assembly.

By keeping production, the primary value making function of the company, healthy and in good flow, the issues discovered in the higher functions can then be taken into con-

siderations to further improve the delivery process as a whole. Furthermore, as a previous attempt of adopting lean principles did not take flight, by communicating the effects of the implementations, the reactivation of lean principles in production should have a solid foundation.

### 7.3 Thesis Evaluation

A proper research plan and strategy contribute to the end quality of the research – the means must meet the intended ends of the research. For the research to be evaluated to be both relevant and acceptable, the research must meet four requirements: Relevance, Validity, Reliability and Logic.

#### 7.3.1 Objective vs Outcome - Relevance

Relevance of the topic is planned to be ensured by first running the business challenge through the decision makers of the company – is the issue relevant? By asking the questions posed by the original business challenge, the relevance of the research topic should come clear. The findings from the current state analysis and the solution derived from them should be checked against the original topic. To further support this relevance, the literature chosen for the conceptual framework should also be relevant to the research. Relevance in the field of the challenge can also be used as a benchmark – can the solutions of the business challenge be applied in other companies in the field?

This thesis was conducted according to the research design as described in Section 2. The objective of the thesis was first defined as finding improvements to the delivery process after a business model change. The thesis addressed the objective with its current state analysis on the current delivery process by identifying issues and weaknesses in it. The current state analysis also defined the scope of the thesis to remain within production planning and material handling, as most of the issues were identified within those functions. The topics were then explored with literature to create a conceptual framework and combined with suggestions from the stakeholders to form the initial proposal. Finally,

the proposal was validated with the feedback and further suggestions from the stakeholders, creating the final proposal for recommendations for improvements to the delivery process.

The thesis had all five functions of the delivery process in the initial scope, but the issues discovered in the current state analysis narrowed the focus down to production planning and material handling. The proposals give some leeway into expanding the improvements to the other functions which were not explored as well.

### 7.3.2 Validity and Reliability

To ensure the validity of the research, one should find an answer to the original question asked. The data should be both accurate and correct. Validity can be ensured by having a detailed description of gathered data. As the research of this thesis is based on qualitative research, it is recommended to have multiple points of data to ensure that there is no researcher bias – all points of view from interviews and other sources should be explored to ensure research validity as the perspectives can be different depending on who is interpreting the research. This information is then matured in the proposal stages with the process key stakeholders to reach the final conclusions. (Quinton & Smallbone 2006: 126-129)

The thesis addressed the criteria of validity by having multiple sources of information in the form of process flowcharts, interviews with stakeholders of the various functions, and discussions with informants. The data was used to create a description of the current delivery process to pinpoint possible issues. The data collection was split between a reasonably long time due to some functions having several stakeholders working at several different shifts and the recent developments in staff reorganization were also taxing regarding the eagerness of the stakeholders to discuss the issues in a frank manner. The reorganization also shifted the duties around the middle management which caused some issues getting the right person to tell about the role of their functions. This could've been mitigated by making the interviews at a brisker pace, but some of the changes in staff came very unexpectedly.

Reliability in research refers to the ability to reproduce the results - Can the same results be reproduced by a different person with a different method at a different time? The reliability of research can be increased in several ways: With better documentation of



data, using differing sources of data and applying authentic, trustworthy theory that has already been established in the field. Using several sources of data, the triangulation of the previously listed methods, results in research that is more reliable in the way that the results can be reproduced consistently. (Quinton & Smallbone 2006: 130-132).

The reliability aspect of this thesis was ensured by collecting the data from multiple sources. Stakeholders in the same functions agreed on the issues that were reported by other stakeholders which triangulated the research quite a bit. One source of data left unexplored were the daily town hall meeting charts which were filled with numbers of delivery reliability, material shortage status, wastage of both raw material and finished products from the previous day. The qualitative nature of the research left these charts unexplored. Another possible issue was that the interviews and discussions could have been recorded to make the statements more to the word rather than a transcription of the data.

### 7.3.3 Logic and Summary

The final criteria for a high-quality study, logic, ensures the research can be easily interpreted. Having design, objective and outcome match each other ensures a logical research. In the case where the priorities change, adjustments in the original research design should be made. In the case of a significant modification to the research design, the change should be a grounded one, supported with proper arguments.

In a logical study, the outcomes from each stage of the research support each other, leading from one stage to the next, starting from the original objective. Each stage of the study should be driven by the initial objective of the business challenge – the research plan should support the objective. The data sources that are used for the current state analysis should be relevant for the objective. The literal sources of the conceptual framework should be supportive of the findings from the current state analysis. Finally, the approach for the validation rounds should match the solution that was proposed.

In summary, the four research evaluation criteria ensure a high-quality research that is relevant to both the company and their peers in the field – a logical package that is valid and reliable. In the case of this thesis, the objective was approached from the initial point of view that there are weaknesses: What are they and where do they originate from? Each stage of the thesis functioned as the basis for the next one, building the outcome

step by step. While some parts of the thesis had to be cut short due to the lack of data from proper stakeholders or the narrowing of the scope, the data was still relevant, valid and reliable. The literary resources backed the proposals as well, but a brief consideration of other tools or methods could have been on topic as well. The food industry follows a pattern of trends, with the lessons learned from this thesis being applicable elsewhere given company-specific adjustments.

#### 7.4 Closing Words

As the food industry develops and changes on an almost yearly basis, the basic incentive to enter the field remains: People need to eat. While the developments in alternative sources of nutrients and packaging technology are a source of innovations, people change their habits very slowly – there are preferred products and seasonal trends that are very hard to disrupt. New products come and go, with customer demand deciding the winners.

By having a production that has its basic functions and the processes that enable them in check, starting from planning to having the right items in the right place to the ability to adapt to new types of production, all one needs to do afterwards to remain ahead of the curve is change the materials in the recipe to the ones the customers' desire to remain relevant and competitive.

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**Field Notes and Interview Log Form for Delivery Process Analysis**

Interviewer: Max Paganus [max.paganus@gmail.com](mailto:max.paganus@gmail.com)

Date & Key Topics:	
Interviewee/Participants:	Location:

Interviews are conducted by having key personnel of the process stage go through the process flow with the interviewer and then going through any deviations from the defined process.

**Primary Questions**

1. Please describe your role in the process described.
2. If there are deviations from the defined process, please show where the deviations occur.
3. Does the process have any issues? Does the issue have possible solutions?
4. Do you have an idea for any improvements in the current process?