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Improving 3-month Sales Forecasting for the Sales Unit

Proposal of a Sales Forecasting Approach

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To be finally on the finish line with this thesis is absolutely awesome. It really has been an interesting journey and along it, I have learned a lot. This Master's program, along with work requires really a huge amount of effort but the prize is certainly a worth of it.

I would like to thank all my colleagues and superiors for the support and patience during the year, I am also grateful about the opportunity to do this thesis for the case company and I thank everyone who participated to it, either directly or indirectly. Special thanks goes to my former superior Jukka who made this opportunity possible in the first place by admitting of my studies and to Jenni about placing this very important task to solve.

This study would still be ready only in my dreams without a support from my instructor Dr. Thomas Rohweder who, whenever I was stuck with the topic, guided me forward. I also want to thank Zinaida Grabovskaia for pushing me further just when the motivation was the lowest. Thank you both for the very professional support!

As this thesis was made mainly on my free time, after the work and especially during the weekends and holidays the biggest thanks goes my family. I thank especially my wife Hanna, without your support this would not have been possible.

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This thesis focuses on improving the short-term sales forecast process in the case company. The current forecast process is not as accurate as desirable, which can be seen, first, on the company financial side and, secondly, on a sold unit delivery time, which has a direct impact on the customer experience. An improved forecasting approach would help the sales and operations planning team of the case company to further develop a more accurate production planning and more optimised material stocks in order to cope and overcome the current problem.

This study combines qualitative and quantitative data in its analyses, but focuses mainly on qualitative data to analyse the current state of the case organisation. The main data sources of this thesis consist of the key stakeholder interviews, workshops and the case company internal material. The current state analysis looks for the strengths and weaknesses of the current short-term sales forecast process which are then used to find a remedy from best practice and existing knowledge. Relevant tools and ides from existing knowledge and literatures are used to design a conceptual framework which is then used to build a draft proposal.

The outcome of this study is an improved 3-month sales forecasting approach, which consists of recommendations for a new forecast process together with specified actions. By implementing the recommended process and actions, the case company would be able to improve its short term sales forecast accuracy, which will further improve the efficiency of Sales and Operation Planning Process.

Keywords	Sales Forecast, 3-months sales forecast, Sales and Operations Planning

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1 Introduction

Forecasting has an important role in every company that manufactures and sells goods. Moreover, the impact of forecasting accuracy can be seen, first, on the company financial side and, secondly, on a sold unit delivery time, which has a direct impact on the customer experience and - through the customer experience - on competitiveness. Thus, a big inventory would seem good to secure the delivery time, as a back-up method for the lack of accurate forecasting, but unfortunately it has a negative financial impact.

From the financial point of view, forecasting has a direct impact on inventory, especially the size of inventory. At the end of the financial reporting period, the inventory appears on the company balance sheet as an asset and further in the company income statement where it has a crucial part when reporting a cost of goods sold. Therefore, inventory valuation has a major impact on the reported profit levels and also on paid income taxes. Moreover, an asset which is tied in the inventory could be invested in other ways. As such, accurate forecasting helps to improve the customer experience via shorter delivery times, and it also allows the company to find better ways to use inventory bound funds. This significant topic of accurate foresting in explored in this Thesis.

1.1 Case Company Background

The case company of this Thesis is a multinational technology company in the power and automation sector operating in some 100 countries and employing about 135,000 people. The case company is organized into four global divisions, which are Electrification Products, Discrete Automation and Motion, Process Automation and Power Grids.

In Finland, the case company is one of the biggest industrial employer. The case company operations are in 20 locations, with its factories situated in location 1, location 2, location 3 and location 4. The case company manufacturing and central stock locations are shown in Figure 3. The total number of employees in Finland is around 5100. The case company offers services, solutions and products for Finnish customers in the power and automation industry.

1.2 Business Challenge, Objective and Outcome

The business challenge for the case company is that the current 3-month sales forecasts are much too inaccurate from the factory 1 point of view and thus need to be made more precise. The case company mainly manufactures stocked items which offers a buffer between the customer and production line. However, some components require from 8 to 10 weeks delivery time and failing on sales forecasting leads to components running out of stock when production is not in synchrony with the true customer demand resulting in delayed delivery times. The factory 1 also acts as a feeder factory for the other factories of the case company, which in the case of inaccurate global forecasting, has an impact also on the other regions.

Accordingly, the objective of this thesis is *to propose a new or improved forecasting approach* in conceptual level for factory 1 in order to improve the sales forecast accuracy. The outcome of this Thesis is a 3-month sales forecasting approach proposed on a basic concept level for the factory 1.

Presently, the case company has a global sales and operation planning process used in its factories. Further on, Section 3.2.1 discusses in detail its global forecasting and demand planning process, before proposing improvement to this current process.

1.3 Thesis Outline

This study is conducted by analysing the strengths and weaknesses of the current Sales and Operations process and further, its sub-processes, demand planning and forecasting. Data for defining the current state is collected by interviewing the process internal key stakeholders and by analysing the case company internal documentation. The theory and best practice for sales forecasting is reviewed in the literature review.

This study is written in seven (7) sections. Section 1 is the Introduction. Section 2, Method and Material, explains the research design, data collection and analysis methods used in this thesis. Section 3, the Current State Analysis, describes the current way of working and analyses the strengths and weaknesses of the Sales and Operation process and further, forecasting and its challenges in the case context. Section 4 covers the existing knowledge concerning sales forecasting in literature and discusses best practice of sales forecasting. Section 5, Co-creating an improved forecasting approach, describes

the first proposal for the improved sales forecasting approach based on the key stakeholder opinions. Section 6, Proposal for improved forecasting approach, shows a new approach on concept level and explains further improvements based on management feedback. Section 7, Discussion and Conclusions, summarises the study and discusses its reliability.

2 Method and Material

This section introduces the Research Approach and Research Design of the thesis. In addition, the data collection and analysis methods are overviewed.

2.1 Research Approach

The Case Study as a research method is particularly appropriate when “how” and “why” questions may be placed, the researcher has scant or no control over the incidents and the focus is on coexistent events within a real life context. (Yin (2009: 2)

According to Yin (2009: 18), there is a duplex, technical definition for the case study approach. He states that the case study is an empirical enquiry that explore a coexistent phenomenon within its contextual for real life, particularly when the borderlines between the phenomenon and the context are not clearly evident. Figure 1 illustrates the case study with a 6-step research process according to Yin (2009:1).

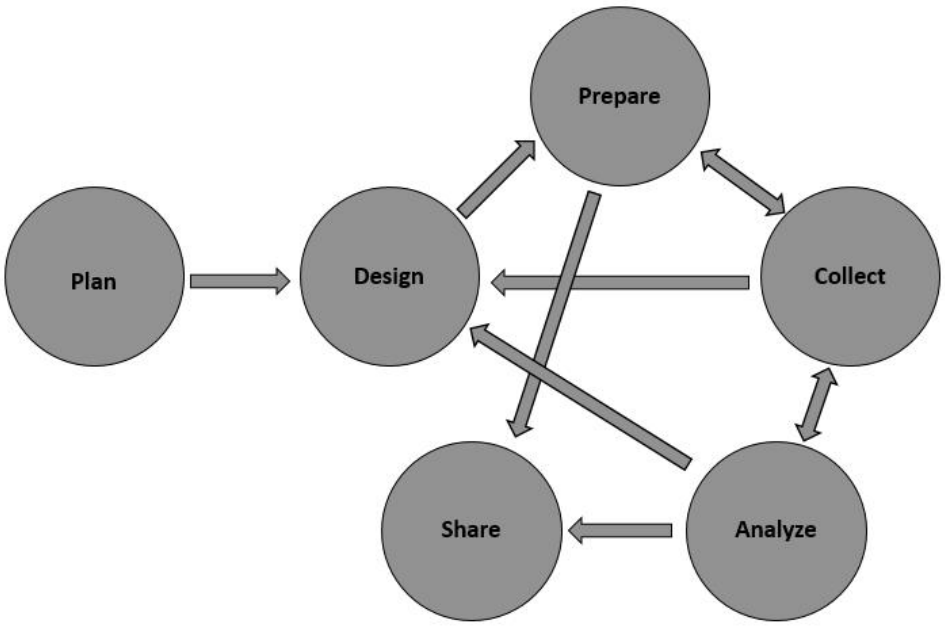


Figure 1. Case study research process (Based on Yin 2009: 1).

As phenomenon and context are not always visible in real word, Yin (2009: 18) proceeds by stating that the case study enquiry deals with the technically definite situation with a many alterable of interests and as one outcome relies on multiple root of evidence with

data needing to merge in a triangulating fashion, another outcome gains from the previous development of theoretical suggestions to guide data collection and analysis.

This Thesis is looking for an answer to the pressing question of how to improve the 3-month sales forecast of the case company. According to Yin (2009:83-84), the data for the case study is collected mostly from documents, interviews, observations and secondary analysis in their everyday situations, Yin (2009:17) continues that the essence of the Case studies is to try to illustrate a decision or a multiple decisions and especially why they were selected, how they were executed and with what kind of results. Therefore, due to the empirical nature of the problem and methods needed for the current state analyse, the Case Study is selected as the research approach for this study.

This thesis combines qualitative and quantitative data in its analyses, but focuses mainly on qualitative data. Qualitative research utilize a real life approach that retrieve to understand phenomena in context-specific environment where the researcher does not try to manipulate the phenomenon of attention (Patton 2001:39). In qualitative research, the aim of the case studies is to describe or reconstruct the case by utilizing data collection methods such as interviews and observation (Flick 2006: 141-142). Gillham (2010) propose that one source for evidence is not adequate but using multiple sources is appropriate for the case study. A research methods used in this study aims at triangulate the sources by interviewing the key stakeholders from all levels of the current sales and operations planning approach and by reviewing the company internal documentation.

2.2 Research Design

A research design is the link between the initial questions of study and the data which is to be collected (Yin 2009:24). The Research design of this Thesis is shown Figure 2. It describes the five steps to take in order to reach an objective. It also shows intermediate outcomes and the data inputs at various stage.

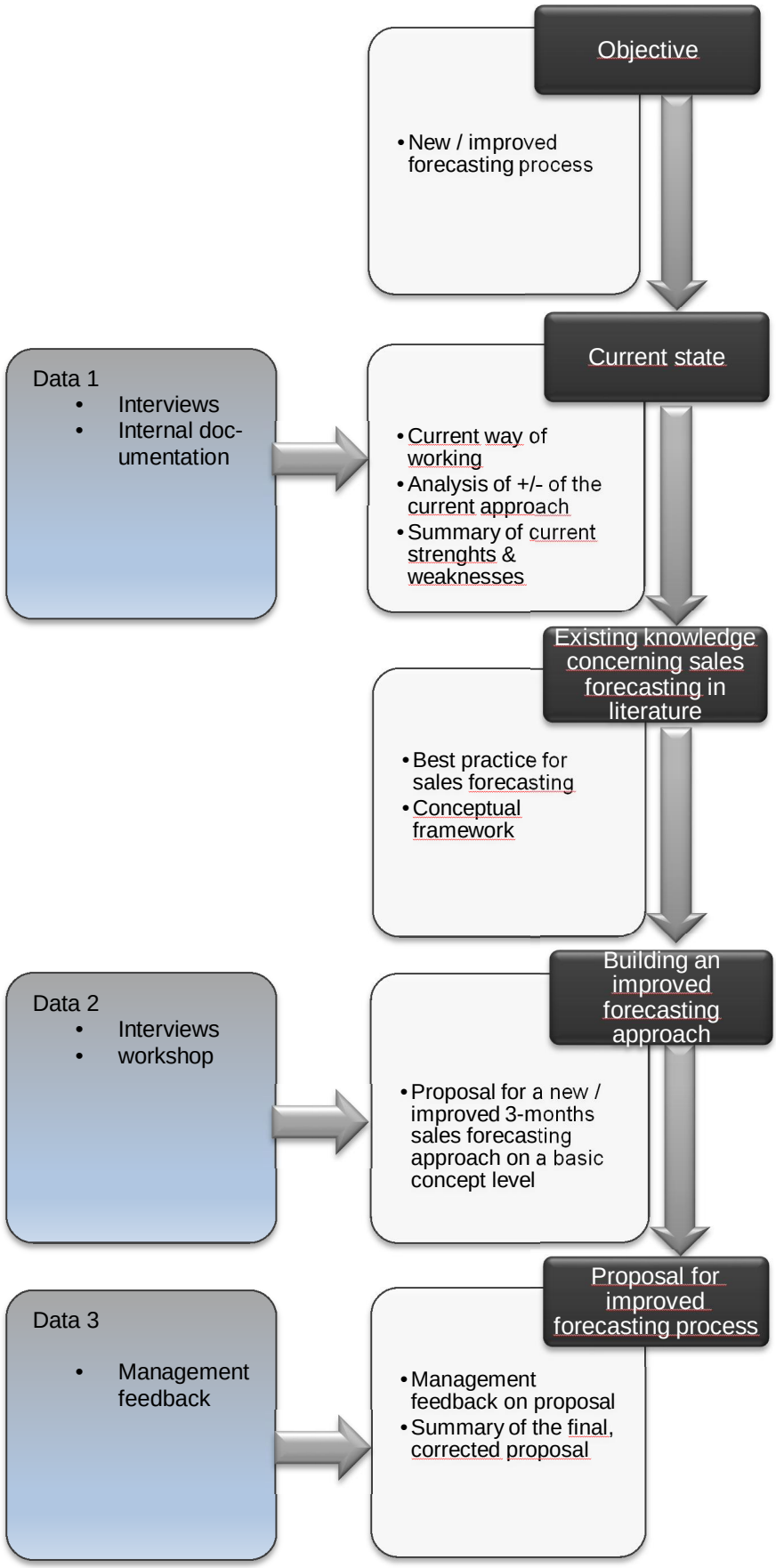


Figure 2. Research design of this study.

As seen in Figure 2, the objective of this Thesis is to propose a new or improved forecasting approach for the case company. The first step is to perform the current state analysis. The target of the current state analysis is to determine the current way of working and as an outcome to map out the current strengths and weaknesses in the current forecasting approach. The current state is defined by interviewing the stakeholders of the current forecasting process and by studying the case company internal documentation.

The existing knowledge and the best practice for forecasting are then studied from the literature. Based on the best practice from literature and findings in the current state analysis, the first version of the proposal is co-operated with the stakeholders of the current forecasting process. The final step of the research process is to validate and improve the approach together with the case company management in order to formulate the final proposal for the improved forecasting approach.

2.3 Data Collection and Analysis

Data for this Thesis is collected from several data sources in three steps. Data 1, for the current state, Data 2 for the Proposal building of improved forecasting approach and Data 3, for building the final, corrected proposal of improved forecasting approach. The main method of data collection was the interviews and workshops with groups and individuals. The interviewees were chosen based on their role in the current Sales and Operation planning process, their roles are shown in Table 2 and 4.

The study was conducted during the first half of 2017 with the interviews and workshop conducted during January to April. The questions and field notes are documented in Appendix 1 and 2.

The individual data collection rounds are described in Table 1 below. The details for the data collection are further detailed in Tables 1, 2 and 3 below.

Table 1. Data collection rounds 1-3.

Data round	Data source	Partici-pants	Content	Outcome	Dura-tion
The current state analysis					
Data 1a	Personal inter-views	S&OP planning team	The current opera-tions forecasting model	Strengths & weak-nesses of the current forecasting model	7,5h (10*45 min)
Data 1b	Internal documen-tation		The current way of working	Strengths & weak-nesses of the current way of working	5 h
Building an improved forecasting approach					
Data 2a	Workshop	Regional Sales, Sales-, & product group manage-ment	Building an improved approach based on weaknesses in the current forecasting model	Suggestion of new / Improved forecast-ing approach	1 h (2*30 min)
	Personal interview	Sales De-velop-ment Manager	Building an improved approach based on tool used in sales process	Suggestion of new / Improved way to use sales process tools for forecasting	2 h
Data 2b	Internal documen-tation		Building an improved approach based on tool used in sales process	Suggestion of new / Improved way to use sales process tools for forecasting	5 h
Piloting of proposal					
Data3	Personal feedback	Operation Director & Sales Director	Management feed-back about new / Im-proved forecasting approach	The final, corrected proposal	1h

As seen from Table 1, the interviews were held in three rounds. The first round of data collection was related to Data 1, the current state analysis, and consisted of personal interviews with the stakeholders of the current sales and operation planning approach and a study of the case company internal documentation. Data collection 1 is further detailed in Table 2 below.

Table 2. Data collection for Data 1a, the current state analysis.

	Informant's position	Data collected	Documentation	Date & Duration
1	Sales & Operations Planning Process Owner	Interview, face-to-face	Recorded	3rd January 2017 47 min.
2	Material Planning Process Owner	Interview, face-to-face	Recorded	10th January 2017 42 min.

3	Production Line Manager	Interview, face-to-face	Recorded	4th January 2017 47 min.
4	Sales Director	Interview, face-to-face	Recorded	5th January 2017 49 min.
5	Team leader, planning and Inventory Management	Interview, face-to-face	Recorded	3rd January 2017 38 min.
6	Production Manager	Interview, face-to-face	Recorded	9th January 2017 45 min.
7	S&OP Trainee	Interview, face-to-face	Recorded	3rd January 2017 47 min.
8	Operations Director	Interview, face-to-face	Recorded	4th January 2017 33 min.
9	Sales Manager	Interview, face-to-face	Recorded	5th January 2017 35 min.
10	Marketing Manager	Interview, face-to-face	Recorded	9th January 2017 50 min.

As seen from Table 2, the key stakeholders of the current sales and operations planning process were involved in Data collection 1. The same set of questions was send individually together with an invitation for the interview. After summing up the recordings all informants received individually a summary about the interview. As all informants desired to have the interview in Finnish also summary is in Finnish.

In addition, the study also used a list of company internal documentation for the current state analysis. Table 3 below shows details of documents used in Data collection 1.

Table 3. List of the case company internal documentation used for the current state analysis Data 1b.

	Document title	Created	Collected from	Short description
1	3AFE000632 Roles and responsibilities, Operations	09/2016	TJ handbook	Define the roles and responsibilities under Operations related processes
2	Planning mix definition process	06/2016	O- Disk	Explain how product mix is defined in demand plan process
3	SOP roles, responsibilities and meetings	01/2017	O- Disk	Define the roles and responsibilities in SOP process
4	Soroban inventory optimization	05/2016	O- Disk	Overview of inventory optimization in Soroban
5	Soroban use and demand planning for super user	11/2016	O- Disk	User guide

As seen from Table 3, the internal documents used in the current state analysis included the process description for sales and operations planning process with the current sales forecasting process.

Data collection 2 was related to building the proposal for the improved forecasting approach. The questions for the workshops and interview for Data 2a were based on the findings of the current state analysis and to the best practice found from the literature. Both of the workshops proposed improvements to the current process based on the weaknesses identified. The list of interviewees are shown in Table 4 below.

Table 4. Data collection for Data 2a, building an improved forecasting approach.

	Informant's position	Data collected	Recorded	Date & Duration
1	Regional Sales	Workshop	Field notes	12th January 2017 30 min.
2	Sales Management	Workshop	Field notes	20th March 2017 30 min.
3	Sales Development Manager	Interview, face-to-face	Field notes, recorded	7th April 2017 120 min.

As seen from Table 4, Data collection 2 included a workshop for a regional sales team and for a sales management. The purpose of the workshops was to find a more effective forecasting approach from the regional sales team point of view and propose its implementation as part of the sales and operations planning process. An interview with a sales development manager revealed the case company plans for the future sales process tool which could be used for a sales forecast approach. Table 5 below show the case company internal material which was used in interview of sales development manager.

Table 5. List of the case company internal documentation used for building an improved forecasting approach Data 2b.

	Document title	Created	Collected from	Short description
1	FACE program overview	09/2015	O- Disk	Introduction to a new global CRM system
2	Bidding tool- User guide	01/2017	O- Disk	User guide for a common quotation tool
3	Opportunity & Quote management guideline	01/2017	O- Disk	Guideline to handle sales opportunities & quotes

4	Recurring opportunities	02/2017	O- Disk	Description about handling re-curring opportunities

Finally, as shown in Table 6 below, the data collection 3 is related to the proposal of improved forecasting approach.

Table 6. Data collection for Data 3, piloting of proposal.

Informant's position	Data collected	Recorded	Date & Duration
Operations Director	Management feed-back	Field notes, recorded	18.04.2017 90 min.
Sales Director			

In this round, the management was interviewed based on the proposal of improved sales forecast approach. A list of interviewees is shown in Table 6. With feedback from the management, the final, corrected proposal of the improved forecasting approach was formulated.

3 Analysis of Current Sales Forecasting Process

This section analyses the current way of doing a sales forecast within the case company Sales and operations planning process. The section consists of four sub-sections covering the most important stages of the sales forecasting process. Based on this analysis, a summary of the strengths and weaknesses of the current sales forecasting process is presented at the end of this section.

3.1 Overview of Current State Analysis Stage

The current state analysis was conducted in four steps. First, an overview of overall process.

Second, the analysis overviews the current ways of working in the organization. It was done by using the case company internal documentation to define the roles and responsibilities in the current Sales and operation planning process to analyze the current approach in details.

Third, the analysis discusses the strength and weaknesses of the current approach. It was done by interviewing the key stake holders of current forecasting approach. The same set of question was asked from all interviewees by asking them explain what is working and what is not working in current approach. The set of questions is shown in Appendix 1. As an end result in total nine strength and thirteen weaknesses was discovered from the current sales and operations process.

Finally, the current strengths and weakness were summarized so that to point to the challenges in the current sales forecasting process and also indicated the needs that can be addressed for creating the foundation for the new, improved approach.

3.2 Description of Current Way of Working

Analysis of the current way of working focuses the current global Demand planning process and local Sales and Operation planning process in the case company. Findings are based on the case company internal documentation listed in Table 3 earlier.

3.2.1 Global Demand Planning Process

Presently, the case company has a global Demand planning process used in its factories. Workflows are run globally and demand planning is done simultaneously by each factory at the same time of the month. The manufacturing locations are show in Figure 3.

(Removed)

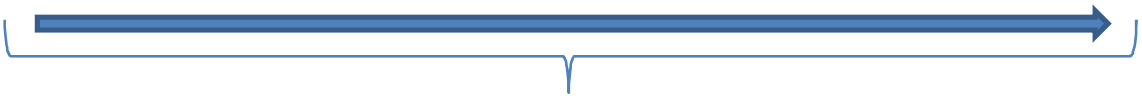
Figure 3. Case company manufacturing locations.

This study focuses on the Helsinki location, among many other shown in Figure 3 above. However, as master data is common for each of these factory units, a global process is led by a global product group controller. Table 7 show the workflow for the global, monthly Demand planning process. A global product group controller is globally responsible for order intake data uploads which is a starting point for a global process, this is shown on Table 7 as steps 1-2.

As seen from Table 7 below, the demand plan process is executed from ~ 2nd to 10th day of each month with some exceptions caused by bank holidays in each factory country. Sales forecast, average price review and statistical forecast review is done locally by each factory and is a part of the local sales and operational planning. The local process is illustrated in the middle of Table 7, steps 3-6 and is explained deeper in Figure 4.

Table 7. Global demand planning monthly workflow (internal document).

Global demand Planning monthly workflow								
1	2	3	4	5	6	7	8	9
Update order intake, inventory, deliveries, order back lock and actual production	Initialise demand planning cycle	Sales forecast	Demand plan preparation, average price review, statistical forecast review	Review	Publish demand forecast by 5pm Finnish time	Area demand plan creation and release	Demand plan review and confirmation by 5pm Finnish time	Detailed demand plan
Duration								
2 days	**1 day**	**1 day (local process)**				**2 days**	**1 day**	**1 day**



From ~ 2nd to 10th day of each month

As seen from Table 7, after the local process (in steps 3-6) is completed, a global product group controller is responsible to create, review and release the global plan. This is shown on Table 7 as steps 7-9.

Factory 1 has also a dependent demand from other factories as it also acts as a feeder factory for some products for the other factories of the case company. These dependent demand figures are not included in to the local demand planning process, therefore this global process is in place. Dependent demand is an interpretation of the sum of all area (local) demand plans and as such the global process defines the global demand related to products which factory 1 is responsible to manufacture.

3.2.2 Local Sales and Operation Planning Process

Local demand plans are part of the local Sales and Operation planning process. Sales and operation planning process is a continuous process which is running in parallel with a global demand plan process, typical duration is 2.5 – 3 weeks per each month.

Sales and Operation planning (later S&OP) process consist of four sub processes, Demand planning, Operations planning, Pre-S&OP meeting and Local Product Group Executive meeting. The cycle and participants of these sub processes are described in Figure 4 below.

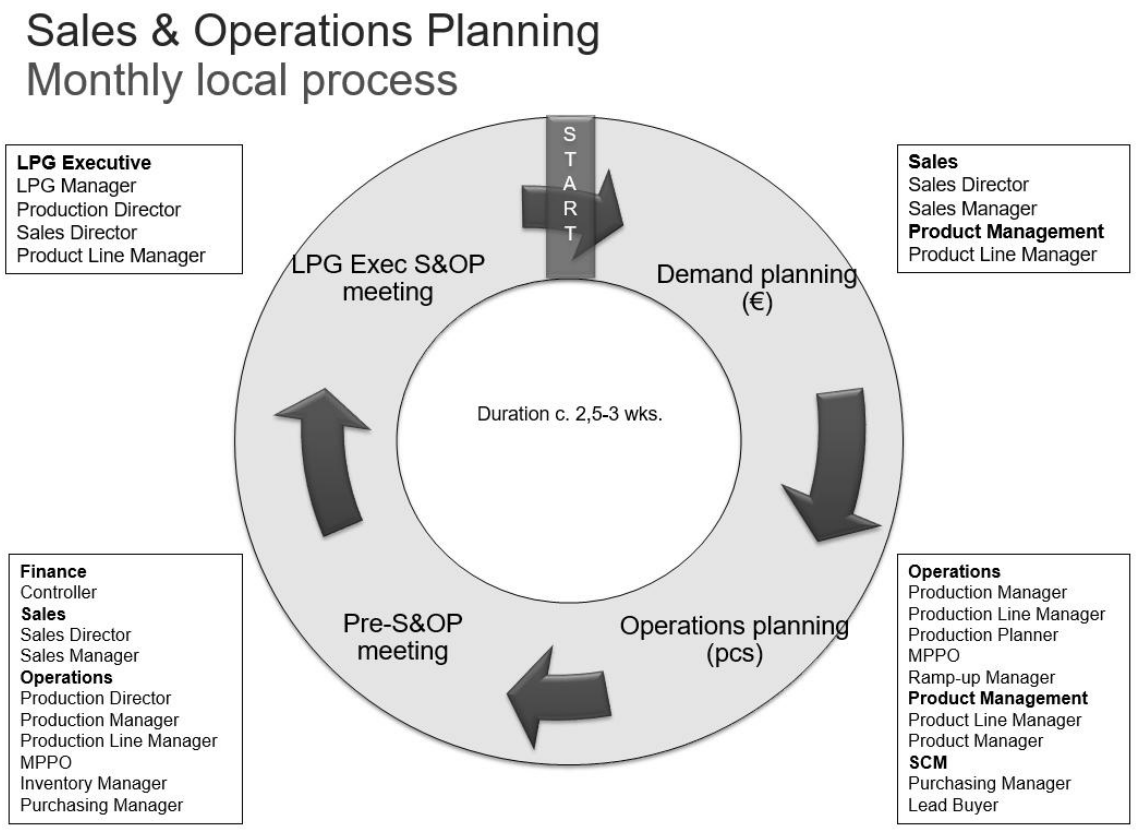


Figure 4. Sales and operation planning monthly process (Case company, 2017. SOP roles, responsibilities and meetings, unpublished internal document.).

As seen from Figure 4, the monthly local process for Sales and Planning consists of four main phases. It starts from Demand planning and continues to Operations planning and Pre-SOP meeting. It ends with a local Product group executive meeting which close the whole process.

Demand planning process is held in a form of a meeting. The purpose of this meeting is to create and update the demand plan and additionally to share the present demand index and a demand planning accuracy results. Functions who participate to this meeting are sales, product management, operations ramp-up managers and planning team. Typical duration of this meeting is 2.5 hours.

Demand plan is given in units of money as it is proportional to the case company expected sales, input for Demand plan is based on historical sales data which is causally corrected. However, until it can be handled in operation plan phase, the demand must be turned into a pieces. This transformation process is shown in Figure 5.

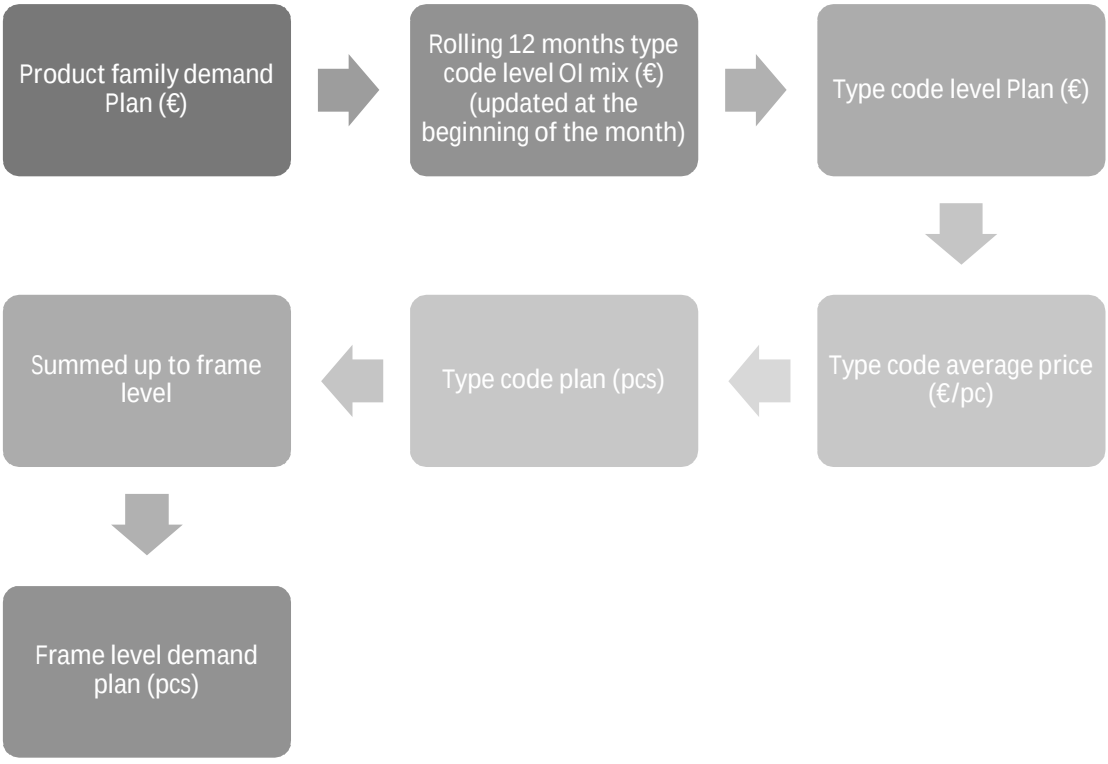


Figure 5. Planning mix definition process (Case company, 2017. Planning mix definition process, unpublished internal document).

As seen from Figure 5, *the planning mix definition process* starts from output of the Sales forecast. It goes through identifying a product mix based on historical sales data in order to break down the sales forecast in a type code level. Finally, by using an average a type code average price the sales forecast is turned to material plan steps.

The Mix is calculated by using the last 12 months order intake data on a type code level the following way

$$Type\ Code\ level\ Mix\ = \frac{Type\ Code\ OI}{Product\ Family\ OI}$$

Then a type code average price is calculated from the last 12 months order intake, as an end result the demand plan is transformed to a pieces and is usable by the operations planning process.

Next, *Operations planning process* consist of a several meetings. Related meetings are inventory and material review, options planning, outsourced production planning and production planning. Purpose of these meetings is to give inventory and material availability review to guide inventory and production planning, to create and update material plan for options and to create and update production plan by reviewing required demand capacity. Functions who participate these meetings are inventory manager, the customer interface management, options planner, lead buyer/purchaser, product line manager, ramp-up manager, production manager and planning team. A typical total duration of these meetings are 3 hours.

From operations planning stage, the process moves to Pre-S&OP meeting. The purpose of Pre-S&OP meeting is to make decision regarding the S&OP plan which is presented to local product group management. Inventory manager give executive summary (max. 3 slides), sales give future sales overview with a special attention to planning horizon which should be at least 3-6 months forward. Functions who participate to this meeting are operations director, sales director, business controller and production line manager. Typical duration of this meeting is 2 hours.

The final stage of the local *Sales and operations planning process* is a Local Product Group Executive meeting, the purpose of this meeting is to give the final approval to S&OP plan with or without changes. Participants for this executive meetings are local product group manager, sales director and operations director. Duration is 30 min.

Summing up, the purpose of Sales and operational process is to balance the demand and supply which is based on information given by sales in Demand plan phase. However, in this case that information is purely based on statistical forecast which is corrected by the trends know from history. Therefore, the visibility to the future demand is limited.

3.2.3 Roles and Responsibilities in Local Sales and Operations Planning Process.

The roles and responsibilities for different functions in the local Sales and operations planning process are listed below.

First, *Sales* collects market and the customer data for the demand plan creation meeting e.g. by discussing with area managers and contacting local sales units. Area managers are responsible to share information about incoming projects, forecast and product changes from the region the area managers are responsible of. Sales creates a demand plan together with a product management including a ramp up/down plan for the relevant products by utilizing the best market demand info available. Sales also presents the outcome of the demand plan creation in the following Pre-S&OP meeting.

Second, *Product management* collects a market and the customer data for the demand plan creation meeting e.g. by discussing with a product managers and forecasts and follows up a product changes on a product line/type level, special focus on a product lifecycle phases and ramp-up/down activities on a country level. Product management creates a demand plan together with a sales including a ramp up/down plan for the relevant products by utilizing the best market demand info available.

Third, *Operations ramp up manager* is responsible to create the operations plan for the ramp-up products.

Fourth, *Lead buyer/Purchaser* is responsible to collect the info regarding possible material availability issues from the suppliers and presents them in material review part in Operations planning meeting. Accordingly, share the information forward to purchasing department regarding demand peaks.

Fifth, *Production planner* arranges and manage a meeting to review the updated material plan in his/her area of production responsibility and writes down the proposal if there is a need for changes in plan and also presents the outcome of the review in Operations planning meeting.

Sixth, *Production line/production manager* participates a material plan review meeting arranged by a production planner and creates a proposals for the plan together with a production planner. Further, responsible to presents the amendments in material plan proposals in pre-S&OP meeting.

Seventh, *Business controller* participates the pre-S&OP meeting and gives his/her comment regarding the financial effect (e.g. EBIT, EBITA, order book, revenue, operational cost, inventory and profit) for the S&OP plan.

Eight, *Sales director and operations director* gives the final approval for the proposed amendments in the S&OP plan before the Executive S&OP meeting.

Finally, *Local product group manager* gives the final approval for the whole S&OP plan with or without changes.

The next section discusses about the strengths and weakness of the current approach

3.3 Analysis of Current Strength and Weaknesses of Current Approach

This section discusses about the strengths and weakness of the current forecasting approach. Findings are based to the interviews shown in Table 2. During the interviews, the interviewees answered all to the same seven questions, the enquiry and related answers are listed in Appendix 1.

The outcome of interviews exposed in total a nine strength and thirteen weaknesses in the current sales and operations process. Found strengths are listed in Table 8.

Table 8. Strengths mapped in the current sales and operations planning approach

	Strengths of the current process
1	**Regular , monthly based process**
2	**Nominated appointees**
3	**4-level approval process**
4	**Process is supported by the management**
5	**Different perspectives are combined to create a general view**
6	**Active products forecasting is very accurate**
7	**Gives input about the market condition**
8	**Systematic process**
9	**Enable to minimize the inventory value**

As seen from Table 8, based on the interview results, the key stakeholders of the current Sales and operation planning process were very contended about the process overall because it was seen very systematic. It was visible in their responses such as the process is regular, systematic and supported by the management. Below a quote about the Sales and operations planning process during the interviews.

> *"This process is heavily person –depending and is has been improved a lot during the years, perhaps the biggest change is that the sales forecast is not made too big by purpose anymore."*(Appendix 1)

The monthly Sales and operations planning process was seen also very reliable as there is an approval process after each step, also as active products forecasting is very accurate the process helps to minimize the inventory value accordingly. Additionally, during the process all different perspectives are combined for one general view about the present market condition. Below a quote about the Sales and operations planning process during the interviews.

> *"I see that very important part of the process is to collect common knowledge about the current market situation."* (Appendix 1)

There were in total thirteen weaknesses found from the current sales and operation planning process, the split of found weaknesses are shown in Figure 6.

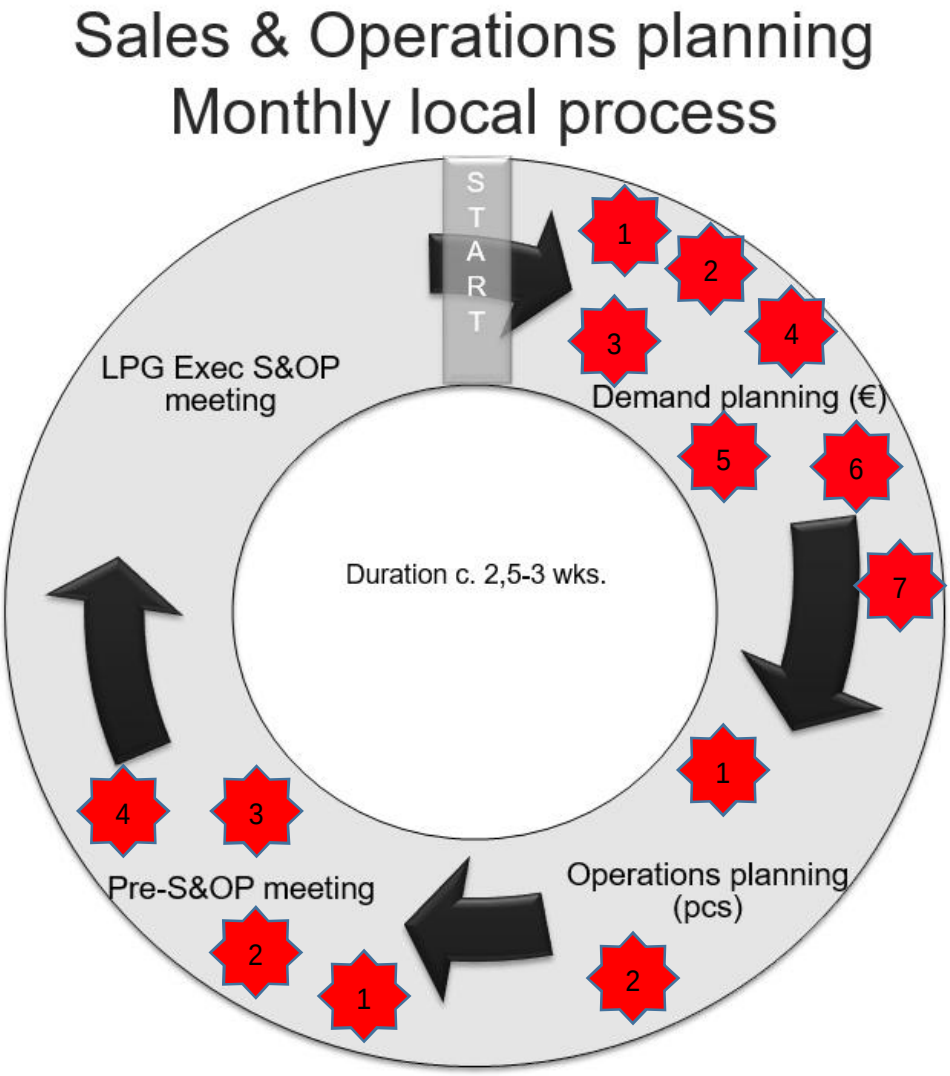


Figure 6. Weaknesses mapped in the current sales and operations planning approach.

As seen in Figure 6, the most of the weakness were found from the Demand planning phase. The weaknesses found under demand plan process are the most crucial from inaccurate sales forecast point of view, there was in total seven of them. Found weaknesses are shown in Table 9. Other findings found under Operations planning and Pre SOP meeting shown in Figure 6 are not relevant for this study and are not further investigated (they are however, listed in Appendix 1).

Table 9. Weaknesses found under demand plan process.

	Weaknesses found under demand plan process
1	**More input from Sales**
2	**Most of the local sales units does not make an accurate forecasting**
3	**Ramp up/down products forecasting extremely difficult**
4	**Sales reporting model does not support PG level forecasting**
5	**Consolidated sales forecast is given from different region what sales is responsible**
6	**Ramp up products need to be over forecasted because of unexpected order peaks**
7	**No process to collect and consolidate a sales forecasts from the local sales units**

As seen from Table 9, the key stakeholders indicated, (1) that more input from sales is needed as sales forecast is the base for a whole sales and operations planning process. Inaccurate sales forecasting is leading to an inaccurate material and production plan which eventually affect to the production lead time and may cause delayed deliveries. Below a quote from a Production line manager during the interviews.

> *"We should be able to sell capacity not units but this would require an information about the demand in beforehand."* (Appendix 1)

(3) It was also seen that forecasting the ramp up / ramp down product sales is extremely difficult. Ramp up products are new, just introduced products which are entering the market and vice versa ramp down products are old, soon obsolete products which are pulled out from the market

(4) A different organizational structures in between country sales units and factory was also seen as a weakness. In factory level Product Group (PG) is responsible about products /production and sales forecasting should direct the demand.
(5)However, in many local sales units the sales is reported matching to local organization structure which varies a lot according to sales unit size, therefore all PG codes may not been opened even though its products are sold and sales reporting goes under another PG.

(6) Especially when a new product is directly replacing the old product the ramp up/down must be in balance that production line managers are able to estimate a needed work-force and further, cover the demand.

The most significant findings from sales forecast accuracy point of view were however,(2) that most of the sales units are not making an accurate sales forecast and that there is (7) no process placed to collect and consolidate a sales forecast from the local sales units. Below a quote about current forecasting approach during the interviews.

> *"We should put more effort to our sales forecasting process, our sales unit should give us more accurate information and the used tools should suit better to the purpose."* (Appendix 1)

3.4 Summary of Current Strengths and Weakness

The target for the current state analysis was to define the current way of working and map out the strengths and weakness from the current sales and operation planning process in order to improve the accuracy of sales forecasting.

Findings from the current state analysis shows that the strength on the current sales and operation planning process is the process itself. The main strengths of the process is that it is systematic, regular monthly based process with a nominated appointees and process itself is enjoying a strong management support. Therefore, the current sales and operation planning process running in monthly base does not need to be improved.

There was, in total, thirteen detected weaknesses in the current sales and operations planning process. However, six of them are not relevant from a sales forecast point of view and left out of further analysis. Accordingly, under the current demand planning process were discovered seven weakness which are directly related to sales forecast accuracy and were further analyzed.

It seems that there is a two main weakness in the current process which basically lead to the other weaknesses. The most outstanding deficiency of the current process is that

(a) *most of the sales units are not making an accurate sales forecast* and that (b) *there is no process placed to collect and consolidate a sales forecast from the local sales units*.

By fixing these two issues also ramp up /ramp down products forecasting would be more accurate as real demand from each sales unit would be known. When real demand is known also the communication from sales side would be more professional which would fix additionally the “more input from sales” issue. The next section studies the best practice from literature to build up an improved forecasting approach based on the findings from the current state analysis.

4 Existing Knowledge on Making Short Term Sales Forecasts

This section discusses available knowledge on forecasting methods and concepts in sales forecasting process, and overviews the best practice to make, combine and consolidate a short term sales forecast.

4.1 Forecasting Process in General

> *"If a man gives no thought about what is distant, he will find sorrow near at hand." (Confucius).*

A forecast as a method is used widely for a different kind of purposes, for example a weather or market trends can be forecasted or people may plan their holidays based on expected future income, nevertheless the target is always the same, to predict the future. Arsham, (1994:6) claims that "forecasting is a prediction of what is occurring in the future, and it is an uncertain process".

For a companies a forecast is a tool that helps a decision makers in their attempts to cope with the uncertainty of the future, companies mainly relay on the current, available data combined with the historical data and analysis about market trends. Armstrong, (2001:2) claims that forecast intended for a decision making is only needed if there is uncertainties about the future. A typical example about such need is to forecast a company sales in order to support a production and inventory on demand planning process.

Moon et al. (2003:7) discuss that an adoption of any process itself is not guarantee a good accuracy for a forecast, therefore companies also need to focus on the way forecasting process is managed and organized. There are several forecasting processes described in the forecasting literature e.g. (Makridakis, et al. 1998:13–16); (Armstrong 2001:8) and (Montgomery et al. 2015:14). However, the difference between various forecasting processes is small as can be seen in comparison below. Figure 7 shows an example of forecasting process used by Montgomery et al. (2015:14).

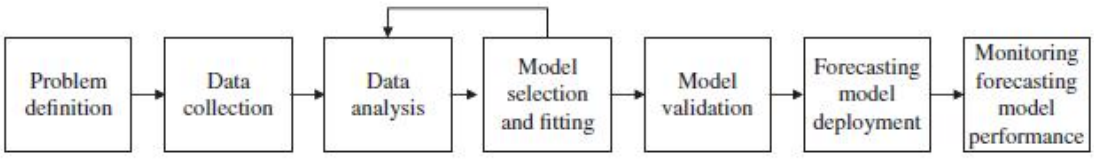


Figure 7. Forecasting process (Montgomery et al. 2015:14).

In Figure 7 and 8 the structure of process is very similar, only difference in practice is in the naming of different steps. Figure 8 is shows a forecasting process presented by Armstrong (2001:8). While Montgomery is talking about Data, Armstrong call the same to information, the same apply to model versus methods and monitoring versus evaluation.

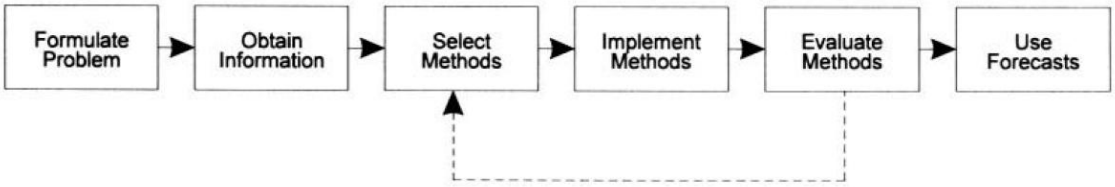


Figure 8. 6 stages of forecasting (Armstrong, 2001:8).

This Thesis focuses to the Armstrong model, with different steps of model described accordingly. Figure 8, "Formulate Problem" can be explained the following way. There have to be a clear objective for making a forecast, the objective outlines which products are forecasted, in which markets and what is the forecast horizon. The outcome of a forecasting process is to maintain a good information flow within the company and also provide the work around on creation of the sales forecast (Danese and Kalchschmidt 2011:205). The forecast horizon is usually related to a production lead time (Montgomery et al. 2015:14). Figure 9 shows an example of production lead time analysis based on to the component lead times Stadtler and Kilger (2004:285).

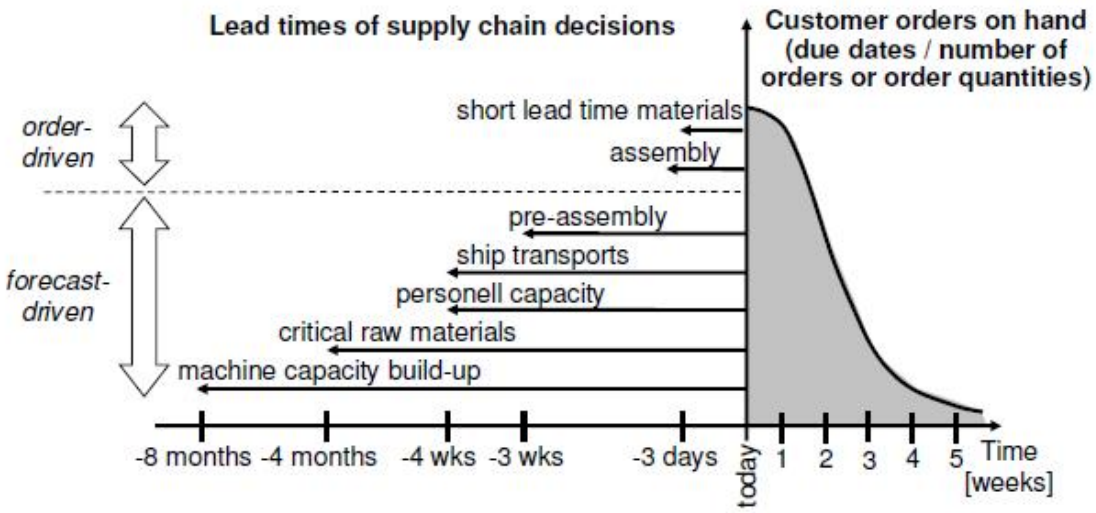


Figure 9. Example of Lead time analysis (Stadtler and Kilger 2004:285).

Figure 9 shows an example of the lead time analysis. Figure 9 shows that the procurement of components with a shorter lead time may be executed order driven while residual

supply chain have longer lead times and therefore execution is driven by the forecast. Montgomery et al. (2015:6) claims that if the forecast lead time is always within the same time period and the forecast is revised after each period then approach is called to rolling or moving horizon forecasting.

Montgomery et al. (2015:2) contends that forecasts are often divided in to the three category, short-term, medium-term, and long-term forecasts. In short-term forecasting process the forecasting period is only a few days, weeks or months into the future. For medium-term forecasts the forecasting period is from months to up to two years into the future and respectively the long-term forecasting period can be extended beyond that by years. All these three different forecasting categories serve a different purpose in sales planning and has a different influence in different level of supply chain. Figure 10 Stadtler and Kilger (2004:87) shows how different forecasting periods effects in to different stages of supply chain.

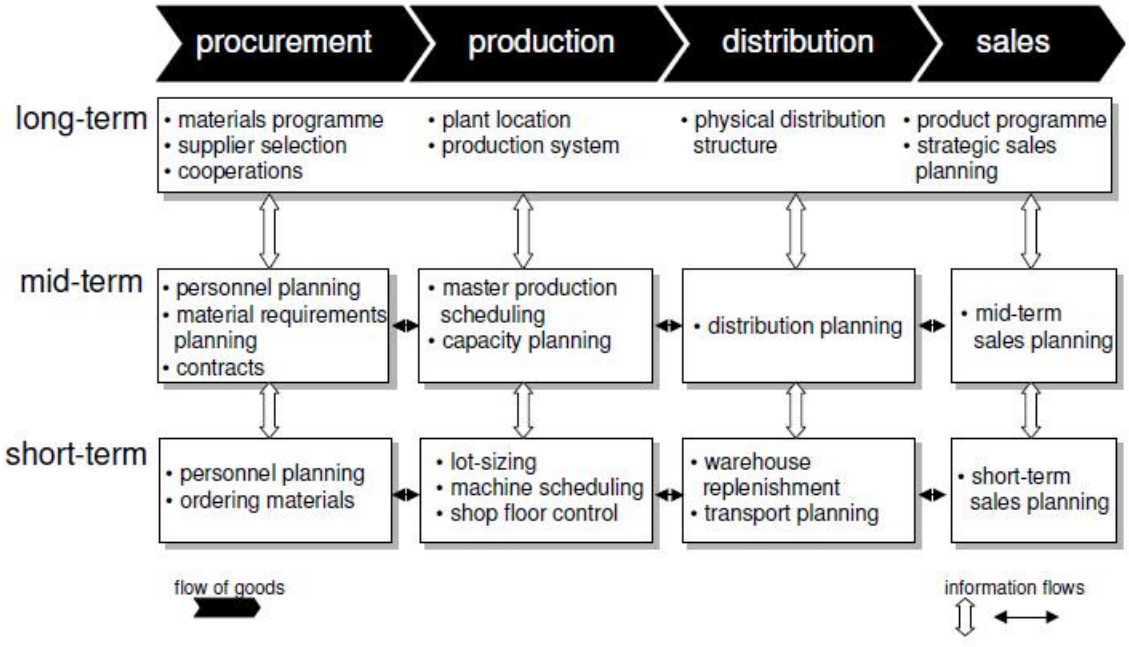


Figure 10. Forecasting planning matrix (Stadtler and Kilger 2004:87).

Figure 10 shows the decision planning matrix. The decision about company future offering is normally based on a long term forecasts. Long term forecasts cogitate the information on product life cycle periods and try to predict economic, political, and competitive factors to help companies to create strategical decisions. This forecast includes the existing product lines, planned future products and also the potential of new business. As it is not possible to estimate exact long-term sales figures item by item, the products

need to be considered as a product groups. The sales potential for product groups for specific regions are predicted in mid-term forecast, this type of forecast is usually calculated on a monthly basis for a one year or less including the effects of mid-term marketing events and promotions on sales.

Short-term forecasting is intended only a few time periods, days, weeks or months into the future and is divided more precisely based on real demand of a certain product. If company is selling products from a stock, the short term sales forecast comprises the stock fulfilment in order to maintain availability. (Stadtler and Kilger 2004: 88-91).

In summary, long-term forecasts are valid for issues such as strategic planning in top management, while short- and medium-term forecasts are necessitates for activities within operations management, sales management and product management. The short-terms forecasts are needed for running daily business and selecting new research and development projects. Further, Armstrong (2001:680) emphasizes that “Forecasts are needed only when they may affect decision making”. In practice, if a short-forecast shows that sales it declining it supposed to have a direct impact to the production and to inventory demand planning, in longer term even a number of employees. Therefore, a working forecasting process need to have an organization acceptance and it need to be implemented in to the managerial processes.

4.2 Data Used for Sales Forecasting

Collected data is in key role when making a forecast as outcome of the forecast can only be as good as the input data is. The second step “Obtain information” in Figure 8 is to gather relevant data for the forecasting process. Once an object for a forecast is defined the sources for the overall data need to be identified in order to collect relevant, valid, and reliable data for a forecast (Armstrong 2001:686). Therefore it is very important to avoid any bias in data collection and use only unbiased and systematic methods to collect the data. The national academies (2010:52) discusses widely about different forms of ignorance which could lead to bias in collecting information for a sales forecast. The different forms of ignorance and methods of mitigation are explained in Figure 11.

Ignorance	Description	Methods of Mitigation
Closed ignorance	Information is available but forecasters are unwilling or unable to consider that some outcomes are unknown to the forecaster.[a]	Self-audit process, regular third-party audits, and open and transparent system with global participation
Open ignorance	Information is available and forecasters are willing to recognize and consider that some outcomes are unknown.	
Personal	Surprise occurs because an individual forecaster lacks knowledge or awareness of the available information.	Explore multiple perspectives from a diverse set of individuals and data sources for data gathering and analysis
Communal	Surprise occurs because a group of forecasters has only similar viewpoints represented or may be less willing to consider the views of forecasters outside the community.	An open and transparent platform that includes viewpoints, data, and assets from a broader set of communities; "vision-widening" exercises such as gaming, scenarios, and workshops; creation of proxies representing extreme perspectives
Novelty	Surprise occurs because the forecasters are unable to anticipate and prepare for external shocks or internal changes in preferences, technologies, or institutions.	Simulating impacts and gaming alternative future outcomes of various potential shocks under different conditions
Complexity	Surprise occurs when inadequate forecasting tools are used to analyze the available data, resulting in inter-relationships, hidden dependencies, feedback loops, and other negative factors that lead to inadequate or incomplete understanding of the data.	Track changes and interrelationships of various systems (i.e., nature, financial markets, social trends) to discover potential macro-effect force changes

Figure 11. Forms of ignorance and methods of mitigation (National academies 2010:52).

As seen from Figure 11, the different forms of ignorance includes a different kind of bias which can be however, mitigated if the root cause is known. If summarizes, it means that a forecasting bias exists when a forecast relies heavily to a too narrow perspective during gathering and analyse the data. Best way to avoid and also mitigate the influence of bias is to use as wide network and as many opinions as possible to collect and analyse the data.

The national academies (2010: 9) continues "Gathering data for its own sake is neither useful nor productive and can result in information overload". Therefore, in order to build and maintain a working forecast process it is important to understand which data is to be collected. A good data collection be composed of prevail the relevant history for the variables which are to be forecasted, comprising a historical information on conceivable predictor variables (Montgomery et al. 2015: 14).

Stadtler and Kilger (2004: 141) states that when a sales forecast is used for Demand planning it is indispensable to consider all available information in the supply chain which could be used to predict the future sales. This information might be often stored scattered, therefore it need to be combined and consolidated. As an example, a sales manager provide input for the forecasting process only of the products and the sales area

he/she is responsible of. All bit and pieces of information are eventually summarized to a one forecast which covers the whole demand.

When collecting the data for a sales forecast and is it used to a demand planning just a sales figures are not enough. Therefore the data in demand planning data base need to consist of at least the three dimensions, based on Stadtler and Kilger (2004:141) the dimensions are:

> *"**Product dimension**: product → product group → product family → product line*;
> ***Geographic dimension**: customer → sales region → DC region/location*;
> ***Time dimension**: different bucket size (days → weeks → years) and horizon"*

These three dimensions are further illustrated in Figure 12 below.

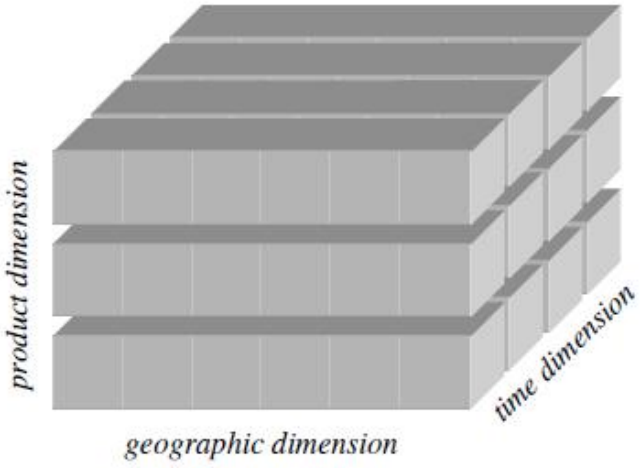


Figure 12. Three-dimensional structure of demand planning data (Stadtler and Kilger 2004:141).

In other words, Figure 12 means that the product and geographical dimension is hierarchically structured while time dimension is normally structured by years, quarters and months. With this structure the forecasted data can be tracked between any combination of product, geography and time, thus its historical data is useful for statistical forecast and a demand planning purpose.

4.3 Choosing Forecasting Method

As seen in Figure 8, the following three steps inside of forecasting process are all related to forecasting methods, the steps are to select, implement and evaluate the forecasting

Method. Makridakis et al. (1982:111) claims that as there is a different needs for the forecast there is also a number of different methods obtainable for a forecasting. Therefore, as always, when alternatives exist, one need to make a decision so that a best forecasting method can be chosen and executed for the certain affair being considered.

Quantitative forecasting methods are used when there is a historical data available. Qualitative techniques are the opposite to quantitative techniques, instead of looking at sales history, a qualitative approach tries to predict the future using only judgmental factors from experienced personnel. Qualitative forecasting methods are used when historical data is not available to carry out quantitative methods. Qualitative methods involve the use of opinions to predict future events and are subjective (Armstrong 2001:390-401). Based on Makridakis et al. (1982:111) the forecasting methods can be divided into three main groups, a purely judgemental approaches, causal or explanatory methods and to statistical methods. Additionally any combination of the above could be used. This Thesis focus on to judgemental and statistical method, causal method is not handled separately but as a part of the statistical method.

Judgemental forecast is a qualitative approach. Judgemental forecast process is typically executed by the company management either individually or in groups. The advantage of judgemental method over a pure statistical forecasting method is that when it is made by a group it can provide a different perspective and a business critical knowledge into the forecasting process. However, the group need to free from social pressures and personal advantages in order to freely exchange information to make a sales forecast. Judgemental forecast method is often used during a launch of new product series when there is limited amount of historical data available. (Goodwin 2014: 6-7)

Statistical forecast is a quantitative approach. This forecast is referred to as a statistical forecast because it uses mathematical formulas together with a historical sales or demand data to try to predict future sales, typically in this case several years' data for a product or product line is available. For a statistical approach there are available a large number of methods, they are known as the time series methods. The underlying assumption is that the trends from the past are continued to stay valid in the future (Gor 2009:148). Statistical method is used when sales is stable and follow historical trend, if seasonal adjustment e.g. for Christmas, Chinese New Year or Ramadan is used then method is a combination of causal and statistical method. The formulation of a causal relationship is not a negligible tread, particularly when the effects are not linear, therefore

one must carefully evaluate which variables are taken under account in forecasting process (Armstrong 2001:174).

Based on Armstrong (2001:391) “Most researchers would agree that there is no single best method of forecasting” and Makridakis and Winkler (1983:995) continues” Using an average of forecasts is undoubtedly better than using a ‘wrong’ model or a single poor forecasting method”. Figure 13 (Armstrong 2001:392) below shows a selection of studies comparing an accuracy of judgmental and statistical forecast when different contextual information is available. In this case contextual information is a trait of the forecasting environment.

	Overall best method	
Contextual information	**Statistical extrapolation**	**Judgment**
None	Adam & Ebert (1976) Lawrence & O'Connor (1992) Sanders (1992)	Lawrence & O'Connor (1996)
Time-series labels only	Carbone & Gorr (1985) O'Connor et al. (1993)	
Public information		Armstrong (1983) Brown et al. (1987) Hopwood & McKeown (1990)
Inside information	Lawrence et al. (1997)	Edmundson et al. (1988) Sanders & Ritzman (1992)

Figure 13. ‘Overall best’ forecasting method based on contextual information (Armstrong 2001:392).

Table 10 below, based on Armstrong (2001:392) explains what kind of contextual information were available for above studies.

Contextual information		
1	None	no contextual information was available, only the time series
2	Time-series labels only	The series were labeled (e.g., “quarterly sales of carpet”), but forecasters were not supplied with any details
3	Public information	A great amount of non-time-series information (qualitative and quantitative) may be available from public sources, but the forecaster has little inside information and control over the forecast variable

4	Inside information	A significant amount of qualitative and quantitative information is available at the highest possible level of detail (e.g. knowledge of price promotions in the future). Moreover, the forecaster may have some influence over the forecast variable.

Table 10. Contextual information, based on (Armstrong 2001:392).

Figure 13 shows a selection of studies about the overall best forecasting method based on contextual information and a Table 10 elucidate which kind contextual information were available for the studies listed in Table 13. The selection of studies clearly shows that the statistical forecast were found the best solution if none or limited amount of contextual information were available and accordingly when contextual information exists then judgemental method were found as best method. Therefore, when there is no clear evidence or a sufficient theory supporting an idea that a particular forecasting method is better than other methods in a particular situation, it might be affordable to consider a combination of several methods. A benefit of combining several forecast methods is that the outcome seems not to be a highly sensitive to the specific choice of methods (Makridakis and Winkler 1983:995).

As seen from the discussion above, choosing the best suit forecasting method based on information on hand is not so easy. However, the existing literature about forecasting recognise some guidelines to select in between judgemental and statistical method when used data series are known. Figure 14 shows a method based on Goodwin (2001:132). Figure 14 shows a prefatory decision tree based on information on hands to choose the most suitable integration method.

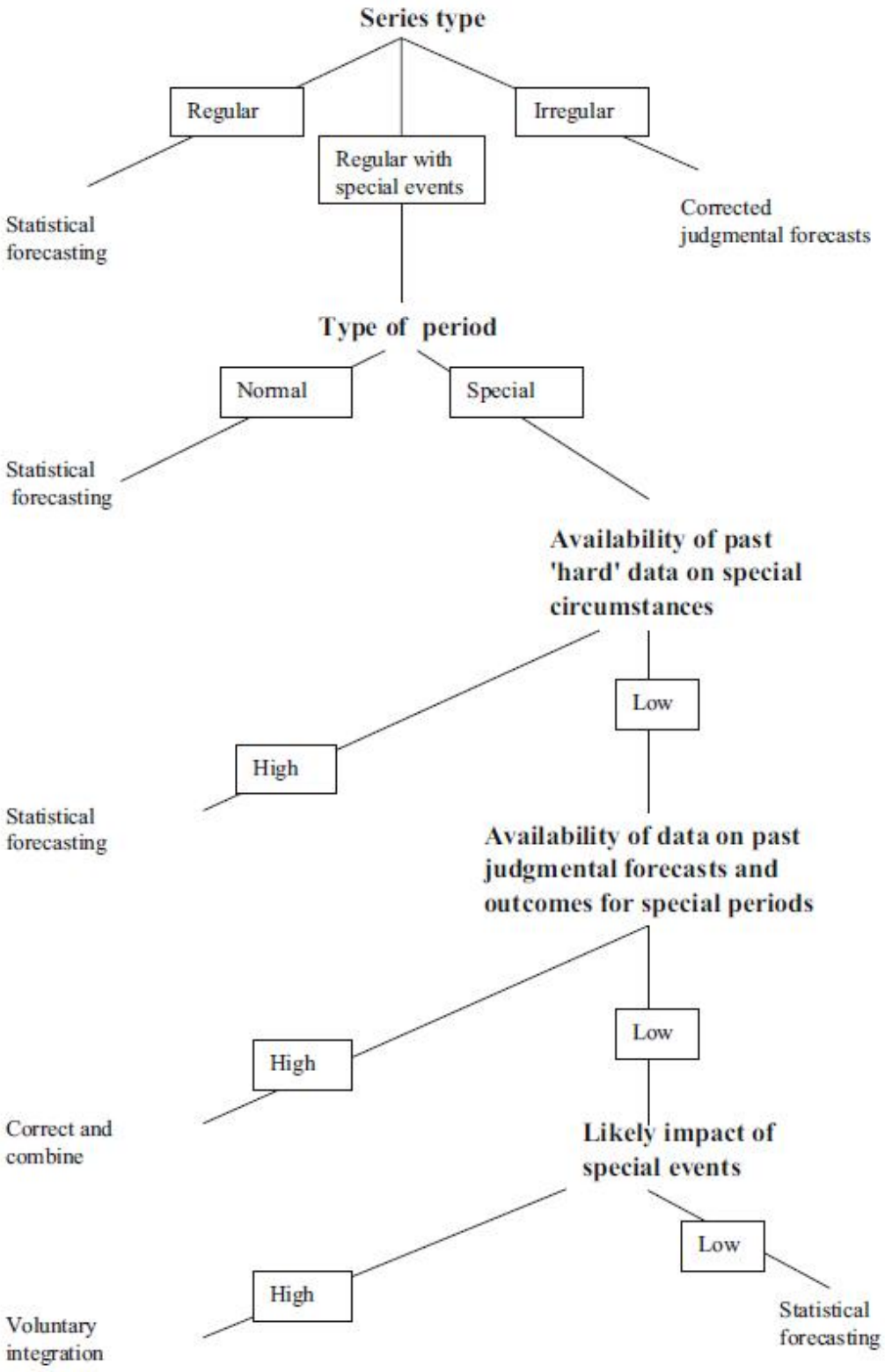


Figure 14. Choosing a forecast method (Goodwin 2001:132).

As seen from Figure 14, a selection between judgemental and statistical method can be made when the used data series are known. In regular pattern where history repeat itself, the statistical forecast is clearly the best solution, in irregular pattern where historical data is not available, the judgemental method suit better. In special events e.g. in case of marketing campaign's or entering to a new market segment the other vice constant data is influenced but effect can be predicted the statistical forecast works best, otherwise a corrected judgemental forecast is needed. However, if impact of these events are seen low from the forecast accuracy point of view then statistical forecast can be used. When a special event is likely to cause a major effect for a variables which are forecasted the voluntary integration should be considered. (Goodwin 2001:131-132)

4.4 Combining and Consolidating Sales Forecast

Combining the forecast is used when a number of forecasts are merged together. Moreover, a consolidation is used when a forecast is needed for a certain purpose, in this case a superfluous information is cleaned off. According to Graefe (2013:2) combining can be adopted a simple and useful approach to reduce the forecast error as it enables forecasters to use more information in an objective manner. Armstrong (2001:417) claims that to improve forecasting accuracy, combine forecasts based on different methods and draw from different sources of information, if possible, use five or more forecast with a different methods. He continues that combining forecasts is especially useful when one is uncertain about the situation or which method is the most accurate and when a large errors need to be avoided.

However, in case of a large international company there could be separate forecasts from several sales regions which need to turn to a centralized one, in this case the separate forecasts need to be combined and consolidated to a one forecast. This require a handling of a large amount of data and is typically not made by humans but with a computer based forecasting system, often with a company CRM system.

4.4.1 Use of Customer Relation Ship Management (CRM) Tool for Forecasting

Customer Relationship Management (CRM) consist of a set of methods and systems which support to optimize profitability, revenue and the customer satisfaction in order to

comprise of all the steps which an organisation utilizes to create and establish valuable relationship with the customers. (Brenski 2015:176) and (Kumar 2015:106-107)

To implement CRM successfully support companies to reach various benefit such capability to create a forecasts based on the customer buying behaviour. CRM system collect and store data about the customers and their activities e.g. buying history and pending offers. Databases are structured and kept update, additionally when arranged correctly also provide access in between different departments to the same data. Forecasting benefit is based on data analysis. Information about the customers gathered by CRM system is used to forecast the future sales. (Brenski 2015:177)

Concept behind is that all the customer related actions are stored to CRM system by users, then CRM system combine the data and share the information for users who might need it. Via CRM system companies can improve their processes and deliver better service with a lower cost but accordingly, companies considerably require analysing huge amount of the customer data. By using new data mining techniques, companies are able to mine unknown information of the customers from large relational databases. (Kumar 2015:107)

4.5 Conceptual Framework of This Thesis

Based on the discussion above, some relevant tools and practices were identified in relation to developing and improving a short-time sales forecast. The identified best practices which are relevant for this study are summarized into the conceptual framework shown in Figure 15 below.

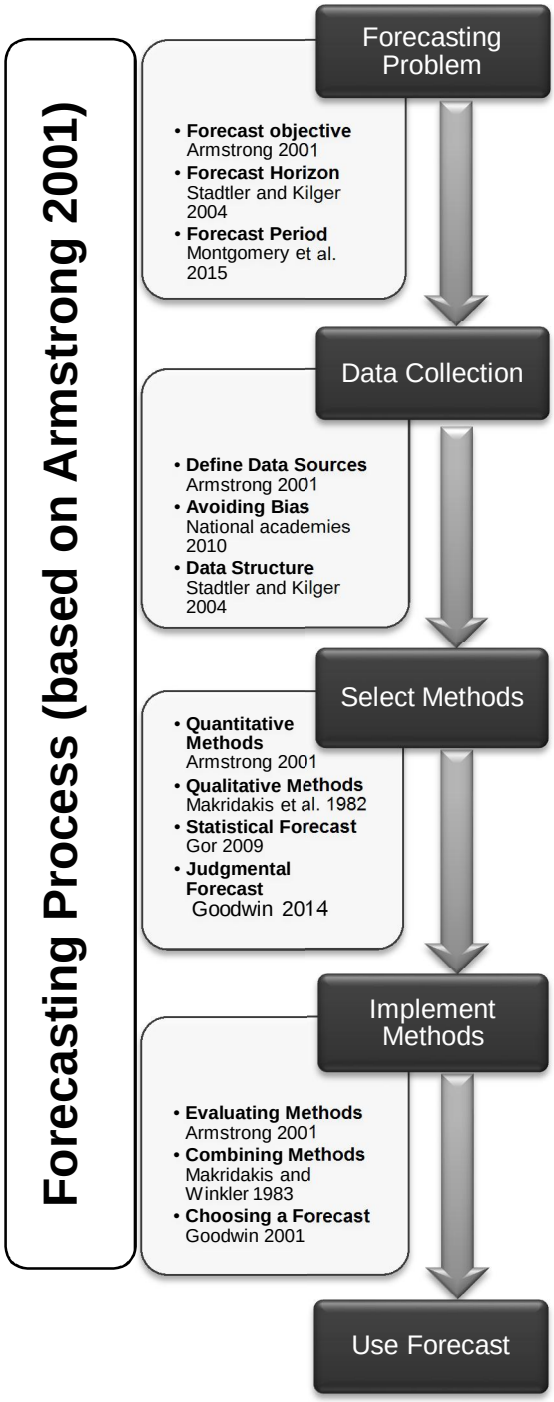


Figure 15. Conceptual framework of this thesis.

As seen from the conceptual framework in Figure 15 above, for developing a short-time sales forecast, first, the forecast problem needs to be defined with a clear objective, secondly, the objective outlines which products are forecasted and in which markets and third, what is the forecast horizon.

Next, the sources for the overall data need to be identified in order to collect relevant, valid, and reliable data for a forecast, it is very important to avoid any bias in data collection and use only unbiased and systematic procedures to collect the data. When selecting a forecast method and when there is no clear evidence or a sufficient theory supporting an idea that a particular forecasting method is better than other methods in a particular situation, it might be affordable to consider a combination of several methods. Combining has been adopted a simple and useful approach to reduce the forecast error as it enables forecasters to use more information in an objective manner. When combine, use five or more forecast with a different methods if possible.

Based on the identified best practice shown in the conceptual framework above and added with the findings from the current state analysis, the new improved forecasting approach is built in the next section.

5 Co-Creating Proposal for the Improved Forecasting Approach

This section combines the findings of the current state analysis together with a conceptual framework to co-create improved forecasting approach based on Data 2 interviews and the case company internal documentation.

5.1 Overview of the Proposal Building Stage

The proposal for the improved 3-months sales forecasting approach is built in 5 steps. First, an overview of overall process.

Second, based on the current state analysis the two main weaknesses in the case company current forecasting process were identified. The first weakness was that most of the local sales units does not make an accurate sales forecast, and the second weakness was that there is no process to collect and consolidate the sales forecasts from the local sales units.

Third, these weaknesses were directed to guide the search for relevant tools and practices to improve the current sales forecast process. It lead to identifying ideas from existing knowledge and merging them into the conceptual framework to create an improved foresting process on a conceptual level and to look for the ways to collect and combine them into an applicable sales forecast approach.

Fourth, the identified ideas merged into the conceptual framework and together with the findings from the current state analysis (from the key stakeholders in sales and sales management of the case company) were incorporated as the starting point for the improved proposal building.

Finally, in the proposal building stage, the key stakeholders in sales and sales management of the case company were again invited to participate in a workshop in order to co-create improved forecasting approach for the case company Sales unit (the questions and collected field notes are listed in Appendix 2). Outcome of the workshop was to build a further questions for a sales development manager who was interviewed about the possibilities of the case company new CRM tool concerning a forecasting process. It was decided that the new approach will be built on top of the new CRM tool which the case company is currently implementing.

Figure 16 below shows a step-by-step proposal building process that was utilized in this study in order to develop the improved 3-months sales forecasting process.

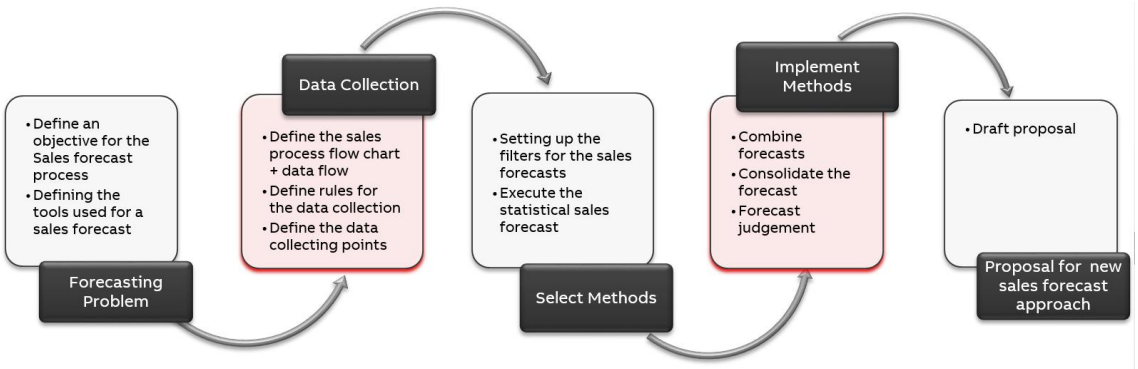


Figure 16. Proposal building process.

In Figure 16, the parts highlighted with the red color address directly the two main issues found from the current state analysis by defining (a) the rules for the local sales unit to approach the forecasting problem, and (b) the tools to combine and consolidate data for the sales forecast. More details on the proposal are described below.

5.2 Target Setting and Tools used for Sales Forecast

According to the business challenge of this thesis, the expected forecast horizon is three months. Further on, based on existing knowledge, for each forecasting process, there is a different objective which corresponds to the expected output.

Based on the workshops during Data 2 round, the expectations for the new forecasting approach, from regional sales point of view, were that the initial data for sales forecast is served by the local Sales units, *on a monthly basis*. Sales management claimed that the tools used for the forecast need to be in line with the group instructions. Therefore, the objective for the forecast approach proposed in this thesis is *a three month sales forecast,* made *monthly,* with *the group specific tools,* by *the local Sales units*. All these requirements are critical to develop the required short-term sales forecast. (The next step along the forecast process, namely the sales forecast consolidation for the use by regional sales and for operations, is further discussed in Section 5.4).

First, regarding *the tools*, according to the case company management decision, the tool called Salesforce will be used as the global CRM (Customer Relationship Management) platform.

This tool Salesforce.com (SFDC) was founded 1999 with a revolutionary idea to offer CRM tool as service rather than as product, in this model the customer benefit is to pay a lower monthly fee instead of investing a millions at the time of purchase. In the beginning of 2001, SFDC released the first version alternative to client-server based programs. As traditional customer owned and server based CRM tools were difficult to install, expensive to upkeep and lacked of mobile access, the market was ready for a web-based CRM solution. The company went public 2004 and is nowadays one of the market leaders in cloud based CRM system business. Today the Salesforce 1 platform provides an ecosystem where the customer is able, without any internal hardware or software to create own, custom tailored business platform which operate in cloud. (Bielawski et al. 2015)

According to the case company decision, the tool Salesforce will be used as the global CRM (Customer Relationship Management) platform and forms the basis for Strategic sales. Strategic sales cover the sales and marketing processes up to quotation which is not included to CRM but made with a different tool in the Operational sales process. Figure 17 below show the Strategic and Operational sales process.

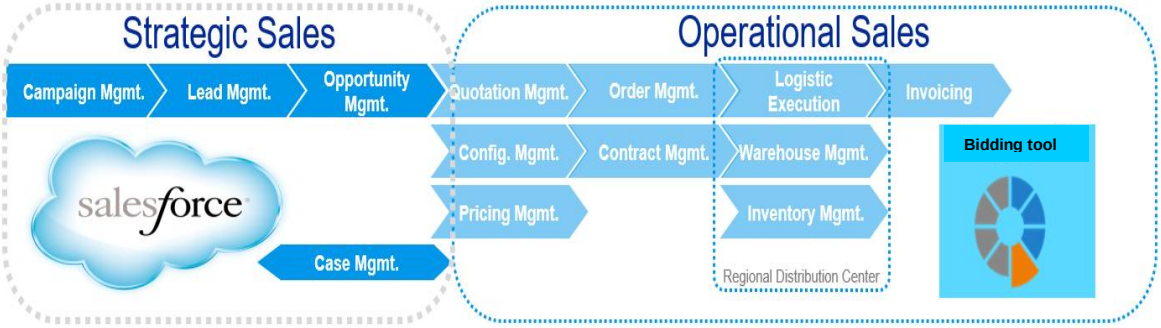


Figure 17. Strategic- and operational sales (internal documentation).

As shown in Figure 17, *Strategic Sales* includes the campaign, lead, opportunity and channel management. *Operational sales* covers the processes from generating a quote to through to managing the customer order. The case company business unit use a tool called BT (Bidding tool) as the global platform for operational sales. The Operational

sales consist of order configuration, pricing, quotation and customer order management through to the customer invoice.

Next, *Bidding tool* (BT) is the case company business unit own tool used globally for operational sales processes such as, quotations, sales support and managing the quotation pipeline. BT is able to support a quotation for standard or configurable products which can be selected and configured either based on simple technical parameters or by using a product configurator in tool. Product description, marketing material and prices are defined and updated centralized by each product group so the latest information is globally available immediately after update. As all data required for offering can be found from one source, all manual work for collecting product prices or technical data is eliminated. BT is implemented to SFDC and sales data in between these two tools is synchronized automatically.

The global implementation of these tools has been started and the target is to cover 95% of the case company business by end of year 2017 with these tools. When tools are in use, all sales related data can be found in one place and data can be used for creating a sales forecast. A proposal for improved sales forecast approach in Chapter 5.5 is developed to rely on these tools.

5.3 Sales Process and Key Data Collecting Points

As the SFDC and BT are able to collect globally 95% of the sales related data by end of the year 2017, this should solve the problem for a sales forecast data collection. However, this is only valid if the collected data supports to create the sales forecast. Therefore the input data is in key role in order to serve a sales forecast later on.

In the tools there are different stages available for a data input which are related to the business opportunity behaviour and to the used sales channel. Figure 18 below describe the customer buying path related to internal business process and the stages when different tools are involved.

(Removed)

Figure 18. Customer buying path related to internal business process: 'Business opportunity handling' stages.

As shown in Figure 18 the business opportunity could be registered to SFDC already in prospecting phase. This is the case for example when customer have a large, long term project which require a lot of back ground work e.g. pre-engineering or designing of the offered scope. If a considerable risk (based on the internal group instructions) is notified then the risk review is mandatory until an actual quotation is able to be made, otherwise the risk review is not needed.

When the business opportunity moves to the quotation phase, all customer and project related information which are fed in SFDC are transferred to BT. From this point forward, all updates are handled in BT which then automatically keep the opportunity updated in SFDC. In some cases e.g. in case of spares, the business opportunity moves directly to quotation phase without any record from SFDC, in that case BT creates automatically an opportunity to SFDC and keep it updated. Below a quote from a Sales development manager during the interview related to the sales process.

> "*As sales hardly ever accepts inflexible sales process, the process descriptions are complicated as there might be a need to jump inside of the sales process to another step without any limitation*". (Appendix 4)

Different scenarios for handling the business opportunities are described in Figure 19 below.

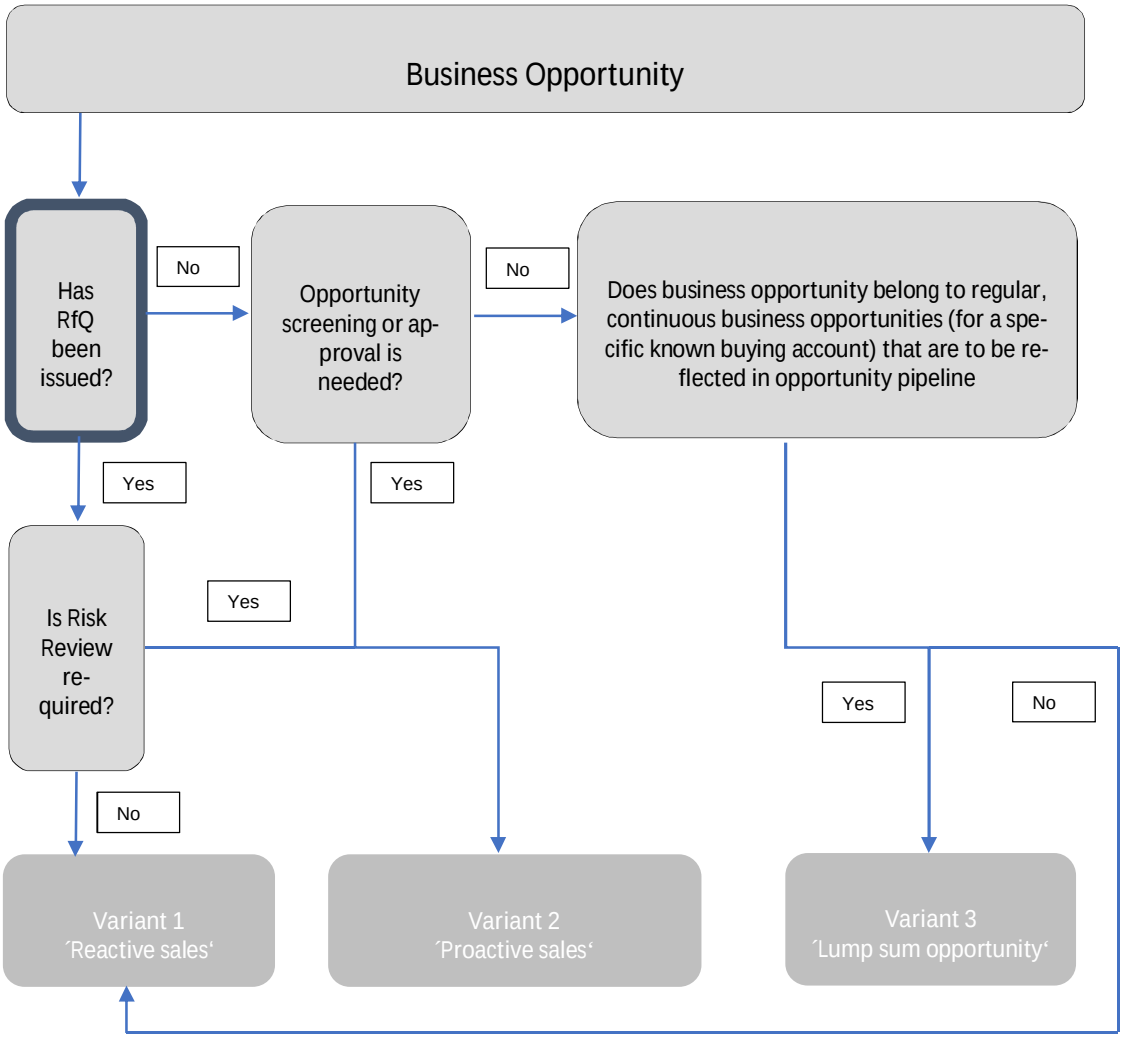


Figure 19. 'Business opportunity handling' process.

As seen in Figure 19, in case a request for quotation is issued by the customer and the risk review is not needed, the quotation process follows Variant 1, *the Reactive sales process,* which is explained below in Figure 20.

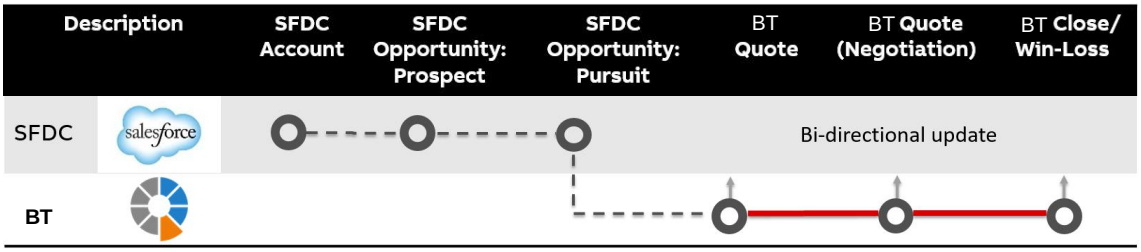


Figure 20. Variant 1, Reactive sales.

As seen from Figure 20, the Variant 1 can be explained as a reactive sales of standard, configured and engineered products as well as spares upon the customer request. A

quotation lead time typically 1-2 days for standard or configured products or services, and as maximum 2 weeks for more complex, configured and engineered products or services. In this case, a quotation is typically made directly in to BT which then creates an opportunity automatically to SFDC.

As seen from Figure 19, when the opportunity screening is done, an approval or a risk review is required, the quotation process follow Variant 2, *the Proactive sales process,* which is opened below in Figure 21.

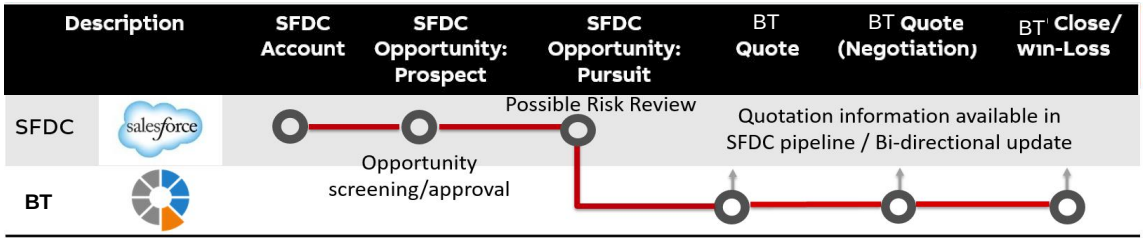


Figure 21. Variant 2, Proactive sales.

As seen from Figure 21, *the Proactive sales process* is based on early awareness of customer project and/or related opportunities. In this process the influence of possible special approvals, pre-engineering or project specific specification need to be taken under account, also depending on the size and complexity of the customer investment, typically higher value opportunities for which risk review can become applicable. Opportunity lifecycle in a range from months to years. Higher likeliness that multiple quotes can exist under one opportunity, to avoid reporting error these quotes need to be grouped. Variant 2 type of opportunities are made in SFDC and also maintained there, when opportunity finally turns to quotation phase it moves to BT, all updates are automatically updated to SFDC.

If the opportunity does not require any special screening or approval but is regular or continuous business, it follows the *Lump sum sales process*. Moreover, the Lump sum process is shown in Figure 22 below. Typical of that kind of business is that sales is based on the agreement between the customer and the case company where the prices, terms and conditions are already defined and additional quotes are not needed. Presently, around 60% of the case company business fells into this category, without this process that amount of business would be invisible, from the forecast point of view, as no quote needs to be done. The *Lump sum process* is shown in Figure 22 below.

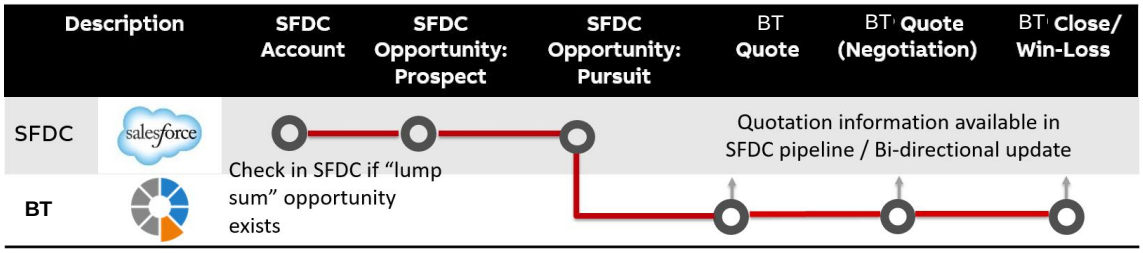


Figure 22. Variant 3, Lump sum opportunity.

As seen in Figure 22, in order to reflect the Lump sum opportunities in the sales pipeline, the Lump sum opportunities can be created in SFDC and cloned to reflect the necessary reporting period. Also quotations can be created from such Lump sum opportunities as in case e.g. update an agreement, in that case the opportunity will be updated from the quotation. These opportunities has to be maintained individually, e.g. opportunity value to be updated and additionally because of the nature of SFDC each opportunity has to be closed after each reporting period, other vice opportunity ends up to an overdue report.

As these business opportunities play a major part of case company business, handling manually each case is quite impossible. Therefore so called recurring opportunity can be created in SFDC. This is automatically rolling opportunity where the user can set e.g. yearly business volume for an account, define reporting period, e.g. one month, when yearly volume is divided in between twelve months. Reporting period can be set to be weekly, monthly or quarterly and business volume can be adjusted manually if there is deviation in orders. As process is automatic, the opportunity start again after each reporting period and closes itself at the end of reporting period thus there is no risk about overdue.

When using a CRM system as data source for a sales forecast, the input data has a crucial impact to the forecast quality. During the interview of sales management, the key data for a sales forecast was identified. Every business opportunity or quotation need to include at least following parameters, 1) primary product group (PG), 2) quote pricing, 3) expected award date, 4)Probability to win and 5) validity period. Figure 23 below show the key data and it location in *business opportunity process*.

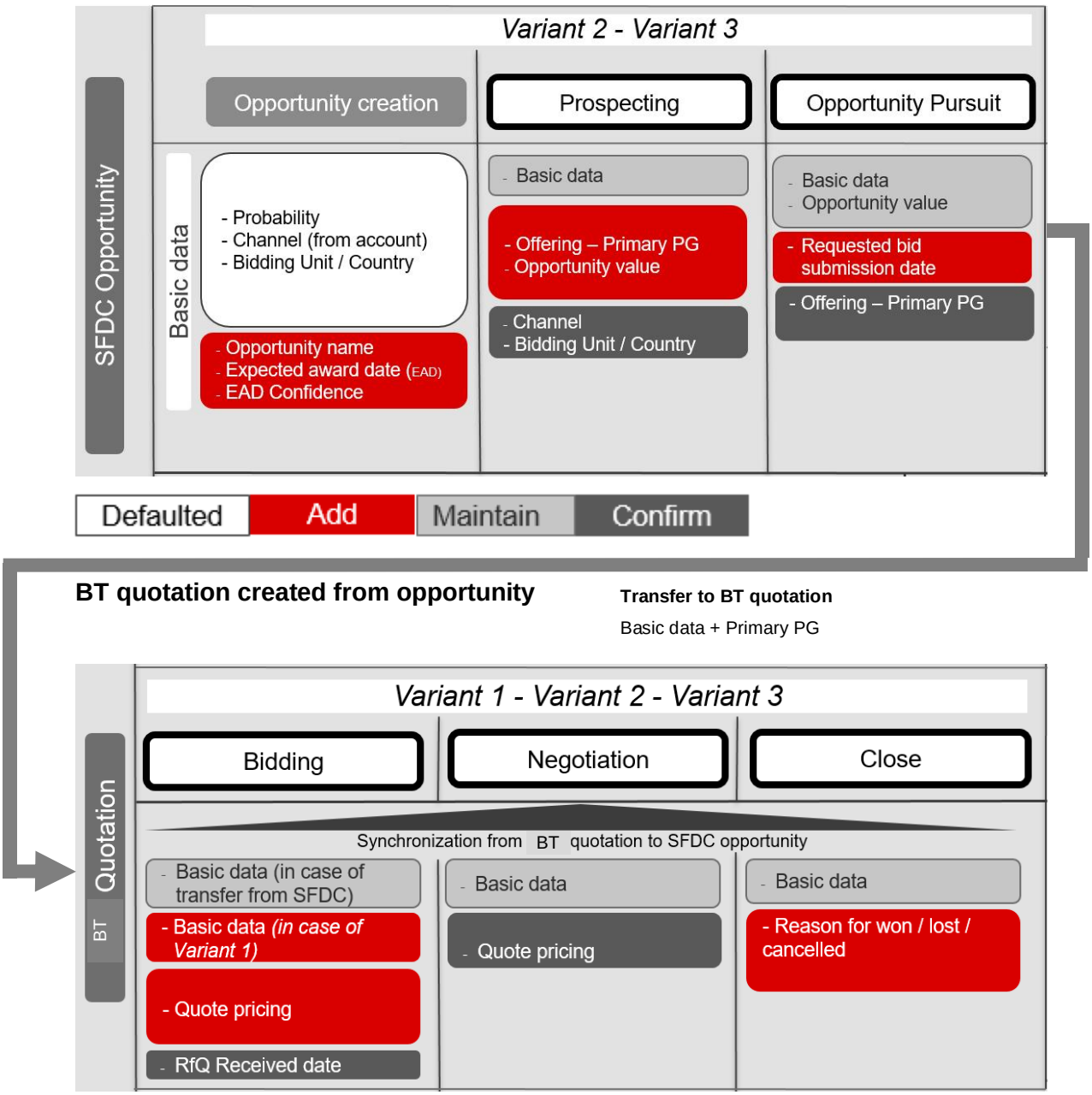


Figure 23. Business opportunity key data & data collection points.

As shown in Figure 23, the data has a different status in each of process locations, it can be added, maintained or confirmed. In case the opportunity is lost, cancelled or post-poned, it is moved to the closing phase and the probability turns to 0%.

5.4 Combine and Consolidate Sales Forecast

When the input data in business opportunity process is correctly placed it is possible to run a report based on it. As there is a synchronization between BT and SFDC, all sales data is available via opportunities and can be taken out for further use. In practice a minimum six filters is needed for a sales forecast. The sales forecast filters are shown in Table 11 below.

Table 11. Forecast filters.

Filter	Output
1. Country(s)	Delimit forecast for a certain country or region
2. Primary product group (PG)	Sets the products range for a forecast
3. Quote pricing	Forecast value
4. Expected award date + **5. quote validity period**	Sets the forecast horizon
6. Probability to win	Sets the certainty of the forecast

As seen from Table 11, the selected filters include a five key parameter from functional sales forecast point of view. (1) A selection for country(s) delimits the forecast for a certain country or region. (2) Primary product group sets the products range for a forecast. (3) Price makes it possible to summarize a forecast value to be used further in Sales and Operations planning process. (4 and 5) Expected award date and quote validity period sets the forecast horizon. Finally, (6) the probability to win sets the certainty for the forecast. Due the limitation of SFDC, there is only three filters in use, the data must be exported to another tool with more filters to run a statistical forecast. The case company has a Microsoft Excel based tool called Sales BI which is used to analyze top opportunities. This tool has already functional interface between SFDC to import data and practically no limitation with the number of filters. By modifying Sales BI interface to import above mentioned data and to use above mentioned filters the statistical sales forecast could be executed and modified according to regional sales and operation's needs.

5.5 Draft Proposal for improved Sales Forecasting Approach

The proposal draft is based on the current state analysis, best practice found from literature, and the results from the workshops and interviews from the proposal building stage (Data 2 collection). During the current state analysis the most of the weakness of current forecasting approach were found under Demand planning process (**Error! Reference source not found.**). Figure 24 below show the location of improved part of sales forecasting approach in current sales and operation planning process.

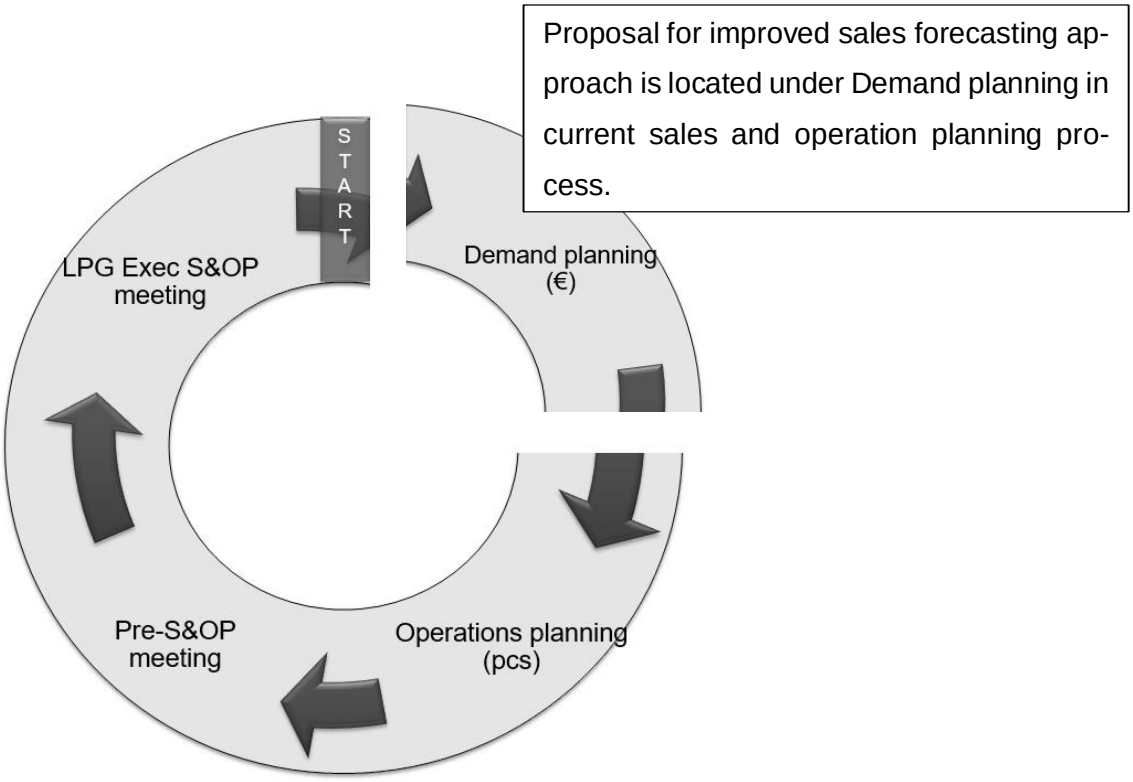


Figure 24. Location of the improved sales forecasting approach in current sales and operation planning process.

As seen from Table 24, the proposal for improved sales forecasting approach is pointed to a current Demand planning process in order to replace the current forecasting approach. The proposal building process follows the logic shown in Figure 16. Proposal building process). Therefore, the proposal draft was designed to follow the steps of the forecasting process including the recommendations for each step to improve the actions within forecasting approach.

In Figure 24, the proposal for the new forecasting approach is built on top of 'ideal' forecast model presented in conceptual framework, and extended with the improvements based on the information gathered in workshops and interviews during Data 2 collection.

Figure 25 below show the draft proposal for improved sales forecasting process with the recommended actions on each step.

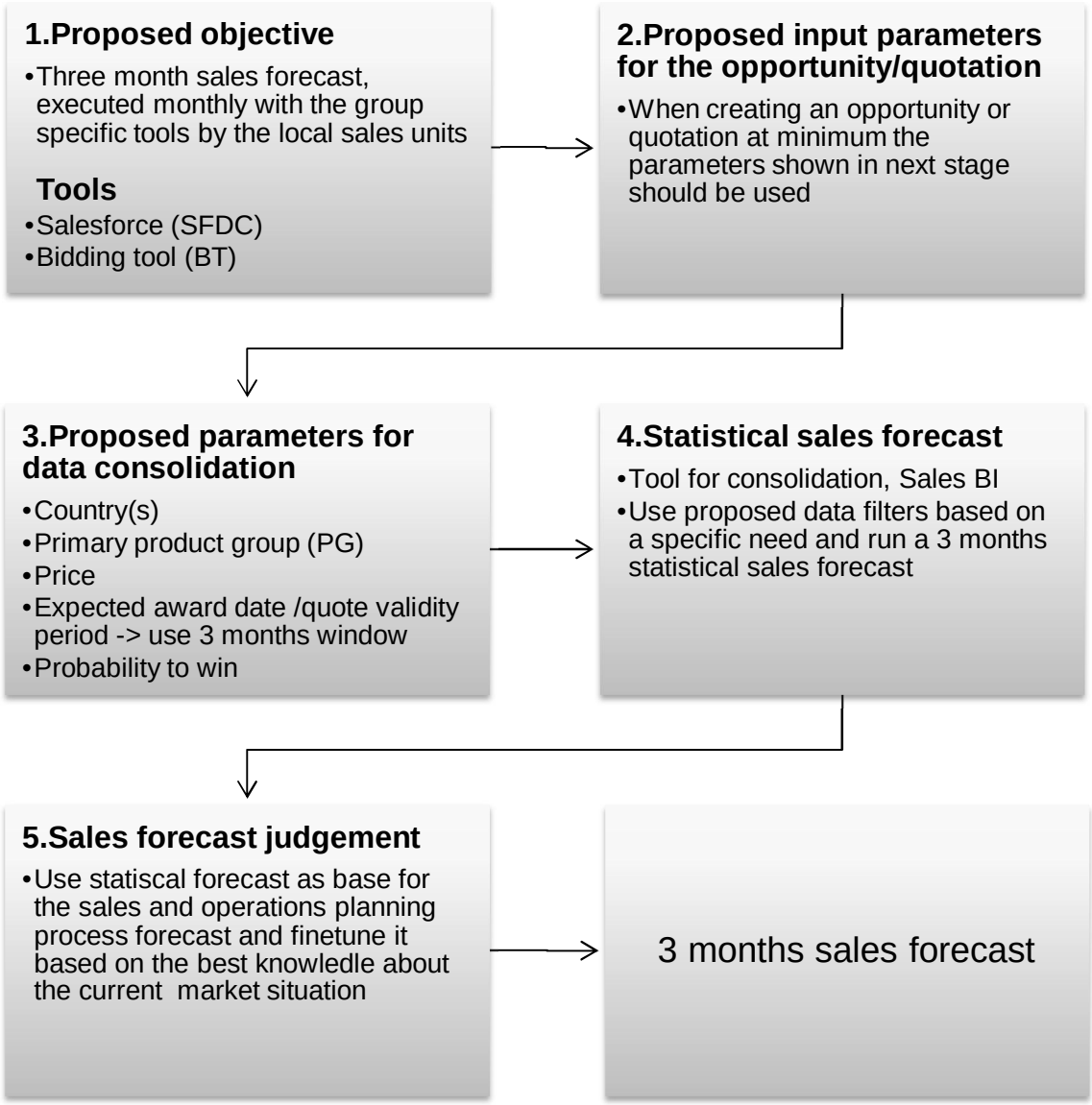


Figure 25. Draft proposal for improved sales forecasting approach.

As can be seen in Figure 25, the process combines with the 'ideal' forecast process explained in Figure 8. 6 stages of forecasting (Armstrong, 2001:8)). A proposal consist of six steps. Each step in the approach follow the proposal building process explained in Figure 16 and show the recommended actions based on chapters 5.2 - 5.4 in order to obtain a three month sales forecast based on real sales figures as the final output.

In step 1, a decision about what is the forecast objective to be made. For this specific sales forecast approach the forecast objective is decided to be three month sales forecast, executed monthly with the group specific tools by the local sales units. Tools to be used are Salesforce and Common quotation platform.

Step 2 and 3, lists the proposed input parameters used when creating an opportunity or quotation. By applying at minimum the proposed parameters for an opportunity or a quotation makes the sales data useful for a sales forecast.

Step 4, consolidation is made with a tool called Sales BI due the lack of filters in Salesforce. Consolidation is made with setting the parameters proposed in steps 2 and 3 as filters in Sales BI. Executing a report creates a very exact three months statistical forecast as the base for a forecast judgement.

Step 5, a sales forecast judgement. In this step the one who is doing the forecast judgment use the best knowledge available about the current market condition e.g. market trends, causal data about the time of the year and company own capability to deliver goods to fine tune a final three month sales forecast. After this step the sales forecast is ready to be released.

Next section discusses the validation of the draft proposal based on management feedback leading to the final proposal.

6 Validation of Proposal for Improved Sales Forecasting Approach

This section discusses how the validation of the proposed approach for improved sales forecasting approach was done and what kind of feedback was given by the management.

6.1 Overview of Validation Phase

Validation of the proposed approach for improved sales forecasting was done by presenting the draft proposal to the management for their evaluation and feedback.

The proposal for a new sales forecast approach with recommended actions was presented to management and they evaluated it on theoretical level. A copy of this thesis up to sections 1-5 was sent to everybody in beforehand and presentation was summarizing the main topic of proposal ending to the draft proposal of improved sales forecasting approach. Feedback was collected with a development ideas to improve the approach to a final proposal. Filed notes can be found from Appendix 5.

Ideally, validation for such a proposal would be done by piloting the proposal in practice. However, due the limited time of implementing this study, a pilot was not feasible.

6.2 Management Evaluation

Table 12 below summarizes Data 3 and shows who was evaluating the draft proposal and what kind of comments they gave about the improved sales forecasting approach.

Table 12. Summary of Data 3, Management evaluation for proposed approach.

	Informant's position	Positive comments	Comments related to further development
1	**Operations Director**	- Looks good, this approach will work when tools are used like it is described.	- Accuracy of this approach should be measured. -How this approach will be implemented in every sales unit. -How are the roles defined for this approach. -Support material need to be easily available and it must be used in order to get the best out of this approach. - Approach is made on product group level, is it possible to make it on product level.
2	**Vice President**	-Looks a very professional, this is what we need. -This will solve the statistical part of problem in our sales forecast, first time we are able to use real figures for a forecast.	
3	**Sales Director**		

Evaluation was mainly positive and conclusion was that there is no need to modify the main proposal. However, there was some comments for further improvement. The most of the comments to improve the approach were related to change management which is not part of this thesis. Therefore those comments are handled in Section 7.2 as a proposal for the future improvements.

6.3 Summary of Final Proposal

The final proposal, after the feedback was implemented in the suggested sales forecasting approach, is shown in Figure 26. The approach stayed as it was but one additional stage was added to the end of the approach. This additional stage, Step 6, is related to the comment that accuracy of this approach should be measured. There was also a comment that proposed approach should be extended to a product level. In reality this is possible as all data from the quotations are available and therefore can be mined, this additional parameter is added to the Step 3 in final proposal.

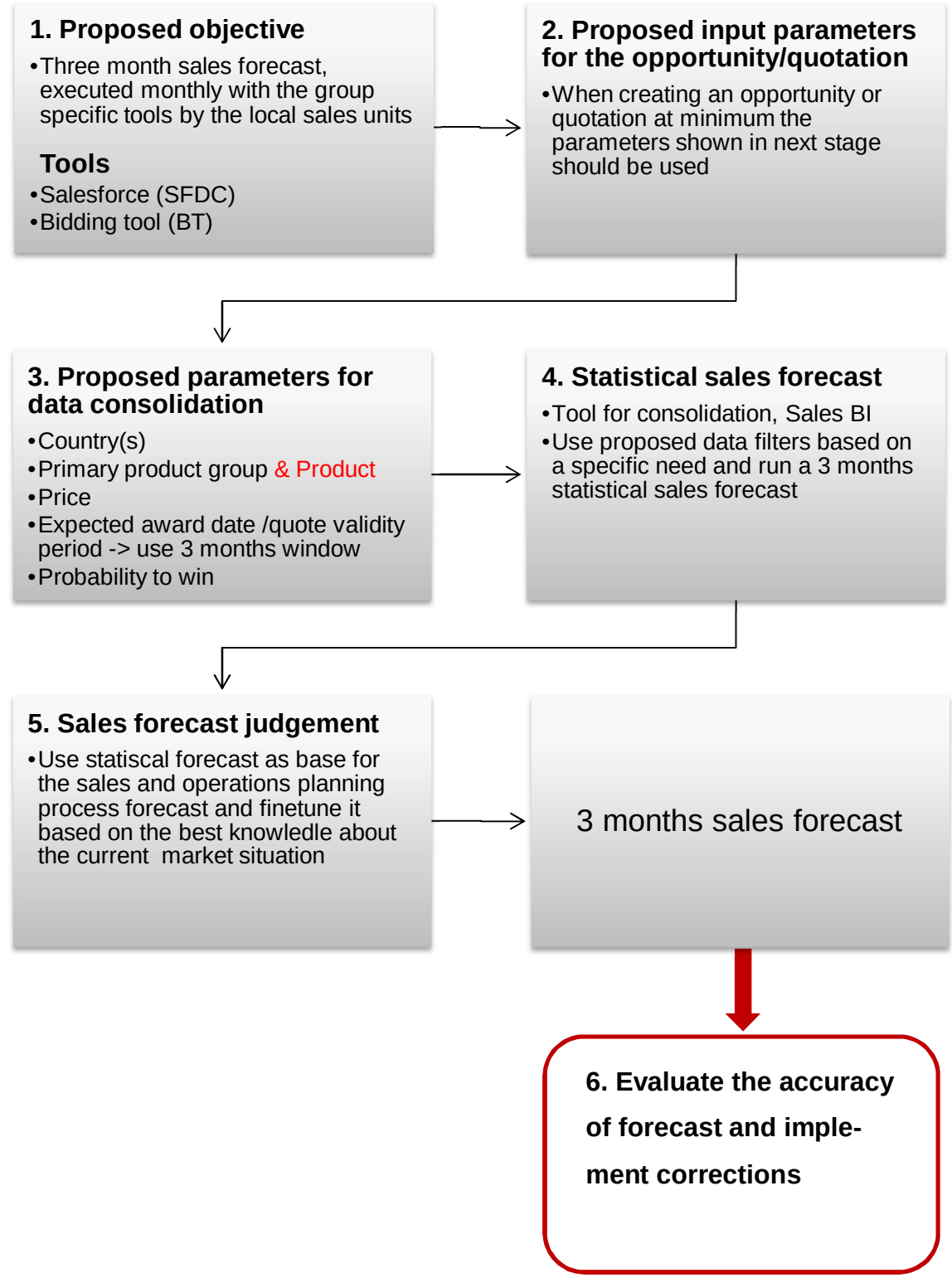


Figure 26. Final proposal.

As seen from Figure 26, the added Step 6 is situated as a part of existing Sales and operations planning process where the process accuracy on product level is already evaluated. Evaluation is made on level which measures the whole factory 1 output. Next

section summarizes the study and discusses the future actions to further improve the proposal.

7 Conclusions

This section summarizes the study and discusses the recommended future actions which are proposed by the researcher to further improve the proposal.

7.1 Summary

The business challenge of this study related to the weaknesses of the current three months sales forecast used in the case company. The current three months sales forecast is too inaccurate, from factory 1 point of view, with a result that production is not in synchrony with the true customer demand which is leading to late delivery times. Therefore, the objective of this study was to propose an improved forecasting approach in conceptual level for factory 1 in order to improve the sales forecast accuracy.

This study was made in five steps. The first step was to perform the current state analysis. The target of the current state analysis was to determine the current way of working and as an outcome to map out the current strengths and weaknesses in the current forecasting approach. The current state was defined by interviewing the stakeholders of the current forecasting process and by studying the case company internal documentation. Accordingly, under the current forecasting process, there were discovered seven weakness which were directly related to sales forecast accuracy and was further analyzed. The conclusion of analysis was that there are two main weakness in the current process that trigger the other weaknesses. The most outstanding deficiency of the current process was that, first, most of the sales units are not making an accurate sales forecast and, second, that there was no process placed to collect and consolidate a sales forecast from the local sales units.

The second step was to study the existing knowledge and the best practice of forecasting from existing best practice and literature. Based on the findings, a sales forecast starts with the identification of a forecast problem need to be defined with a clear objective. The objective outlines which products are forecasted, in which markets and what is the forecast horizon. The sources for the overall data need to be identified in order to collect relevant, valid, and reliable data for a forecast, it is crucial to avoid any bias in data collection and use only unbiased and systematic procedures to collect the data. When selecting a forecast method and when there is no clear evidence or a sufficient theory supporting an idea that a particular forecasting method is better than other methods in a particular situation, it might be affordable to consider a combination of several methods.

Combining of different forecasts is a simple and useful approach to reduce the forecast error as it enables forecasters to use more information in an objective manner. When forecasts are combined, the forecast approach can use five or more forecasts, from different methods if possible. Best practice from literature and the findings from the current state analysis led to formulating such a combined forecast approach in this study. It was merged into the conceptual framework for building the proposal.

The third step was to create a proposal building process which was based on the conceptual framework and to the key weaknesses found during current state analysis. Proposal for the new forecasting approach was built as a development from the 'ideal' forecast model (presented in the conceptual framework) and extended with the improvements were based to the information gathered in workshops and interviews during Data 2 collection. Then, the first version of the proposal for improved sales forecast approach was co-created with the key stakeholders of the current forecasting process.

The proposal for improved sales forecasting approach is pointed to a current Demand planning process in order to replace the current forecasting approach. The proposal consist of six steps. In step 1, a decision about what is the forecast objective to be made. For this specific sales forecast approach the forecast objective is decided to be three month sales fore-cast, executed monthly with the group specific tools by the local sales units. Tools to be used are Salesforce and Common quotation platform. Step 2 and 3 lists the proposed input parameters used when creating an opportunity or quotation. By applying at minimum the proposed parameters for an opportunity or a quotation makes the sales data useful for a sales forecast. In Step 4, consolidation is made with a tool called Sales BI due the lack of filters in Salesforce. Consolidation is made with setting the parameters proposed in steps 2 and 3 as filters in Sales BI. Executing a report creates a very exact three months statistical forecast as the base for a forecast judgement. In Step 5, a sales forecast judgement. In this step the one who is doing the forecast judgment use the best knowledge available about the current market condition e.g. market trends, causal data about the time of the year and company own capability to deliver goods to fine tune a final three month sales forecast. After this step the sales forecast is ready to be released. In addition, according to the management evaluation of the proposed approach, one additional stage was implement to the proposed process. In Step 6, the accuracy of sales forecast is evaluated and needed corrections are implemented on next round.

Thus, the outcome of this study is a proposal for improved three month sales forecasting approach on a basic concept level for the factory 1. It includes a process flow chart with a proposed forecast objective, tools and recommended actions in each step in order to reach a proposed outcome.

The Implementation of the new forecasting approach improves the short term sales forecast accuracy and has a direct business impact, namely (a) the component stock is running with a better accuracy, (b) fewer extra hours needed in production as production is better in sync with the real demand, (c) normal delivery methods can be used instead of express delivery. When production is in synchrony with the real customer demand, also the delivery times are easier to keep which lead to a better customer experience.

7.2 Next Steps and Recommendations

As an outcome of the management evaluation, there were three additional open topics raised which need to be taken into account. These are given as recommendation for further actions to consider. Recommended further actions are listed below.

First, the implementation of the improved sales forecast approach can be recommended in all Sales units.

Second, the implementation would need to define the roles inside of the improved sales forecast approach.

Third, the implementation would need to prepare a support material for improved sales forecast approach.

All these topics are related to change management process which need to be executed in any case when the proposed approach for a new sales forecast is ramped up.

In addition, during the management evaluations, one serious problem related to component delivery time versus the forecast horizon came to light. In Figure 9. Example of Lead time analysis (Stadtler and Kilger 2004:285).), it is explained how a product lead time affects to the forecast horizon. In practice if goods are made to order without any stocking, the product delivery time equals to the forecast horizon. If there is any component(s)

in the supply chain which delivery time is longer than the promised delivery time of the readymade product this might lead to a problem.

When unexpected peak in orders exceed the number of components available, specifically those with a long delivery time the sales forecast will not react on this. The reason for this is that the sales forecast only "see" up to forecast horizon which in this case is a shorter than the actual delivery time of the component. In this case, the sales forecast is 100% correct but the component stock is empty and deliveries are delayed.

Therefore, a recommended action to fix this issue is to either improve the component delivery time in the supply chain so that it is in a range of forecast horizon or to adjust the readymade product delivery time accordingly.

7.3 Thesis Evaluation

The researcher applied a systematic approach to solve the business challenge so that the outcome, a recommendation for an improved three months forecasting approach, could meet the requirements of the objective. The objective of this thesis was to propose a new or improved forecasting approach in conceptual level for factory 1 in order to improve the sales forecast accuracy. Thus, the outcome of this thesis is an improved sales forecast approach which is co-created together with the case company key stakeholders and further improved based on the case company management evaluation. This outcome can be used as starting point to improve the sales forecast accuracy.

7.3.1 Validity

When conducting of an academic study, it is necessary to discuss the topic validity and reliability and also the relevance and logic of the study and its outcomes. In a rigorous study, the concepts like reliability, validity and triangulation, especially in qualitative research, have to be defined in order to ensure the multiple ways of establishing truth (Golafshani 2003:597). This study mainly focuses on qualitative data thus a definition of the above concepts is important.

Validity of a study comprises how well the research responds to the studied objective, and reflects on the validity of the tools used (Yin 2009:40-43). In a valid study, the data is rigorous, precisely deciphered and answers the research problem. Research problem

and methods are grounded to the objective and to the outcome of the study. It is done to ensure that the tools are actually measuring what they are intended to measure (Golafshani 2003:599).

In this study, to secure validity it was necessary to use different sources of information and valid tools for analyzing the current situation as well as building the proposal. Information is collected by stakeholder interviews, workshops and by analyzing internal company documentation in order to formulate a holistic view of the current state. The current state analysis includes data from Operation, Production and Sales. Building the proposal for the improved sales forecasting approach is done in cooperation with the key stakeholders, and the strength and weaknesses of the current process are taken into consideration. The final proposal takes into account the feedback from the Management.

7.3.2 Reliability

Reliability of a study characterize the logic of the study and ensure that it can be repeated by another person by using a different data collection methods, or by repeating the study at a different point in time (Yin 2009:45).

In this study, the case company current forecasting process is a corollary of its organizational structure and a compromise between a numbers of process. Thus, information is collected from all stakeholders which participate in this process and the issue of bias is taken care of during this study by asking the same set of questions from all interviewees, recording the interviews and conclude the outcome of interviews before the literature review.

7.3.3 Logic

Logic is an explanation for a cause-and-effect continuum in the case of an action or a solution (Business Dictionary: Logic). In this study, logic is ensured by identifying the weaknesses of the current forecasting approach. The current state is defined by interviewing the stakeholders of the current forecasting process and by studying the case company internal documentation. Based on the findings of the current state analysis, the existing knowledge and suggestions for the best practice are then studied from the literature. Based on the best practice from literature and findings in the current state analysis,

the first version of the proposal is co-operated with the stakeholders of the current forecasting process. The final step of the research process is to validate and improve the approach together with the case company management in order to formulate the final proposal for the improved forecasting approach.

7.3.4 Relevance

Finally, *relevance* means that if something which is implied by the task, increases the likelihood of accomplishing the goal, it is relevant to the task (Hjørland and Christensen 2002).The topic of this thesis is very relevant for the case company as its business challenge was way too inaccurate short term sales forecast. Failing on sales forecasting leads to components running out of stock when production is not in synchrony with the true customer demand resulting in delayed delivery times. This is leading additional costs when component stock need to be refilled with a faster methods than normally and as production lines need to do extra hours to close the gap in delayed deliveries. The outcome of this Thesis is an improved 3-month sales forecasting approach which helps the case company to make more precise short term sales forecast and cut additional costs related. Eventually, the relevance of the outcome was tested with an evaluation by the case company management which was leading to the final proposal.

7.4 Final Words

Finally, although the study aimed to improve as thoroughly as possible the case company forecast approach, there are some limitations in this paper. First of all, the outcome of the study is only evaluated on theoretical level. The ideal validation for such a proposal would be done by piloting the proposal in practice but due the limited time of implementing this study, a pilot was not feasible. Secondly, the change management was not part of this proposal. The case company sales is active more than in a hundred country and implement of fully synchronized and identical way to use the tools in the sales units will be a challenge. Thirdly, as explained in Section 7.2, even ideal forecast does not solve the original business challenge if even one component delivery time is longer than a readymade product delivery time.

All these demanding questions are waiting for the next researcher to deal with, which the author of this study warmly welcomes and looks forward with a high interest for resumption.

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Appendix 1.

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Appendix 2.

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