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DEVELOPING SALES AND OPERATIONS PLANNING - PROCESS

– Case: Tepcomp Oy



MASTER'S THESIS | ABSTRACT

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The objective of this thesis was to find out the current state of sales and operations planning (S&OP) process, possible improvement areas, and to create a development proposal of how the process can be improved and what the process could look like in the future for Tepcomp Oy. The company sees the S&OP process as an important part of the company's entire business, but even more critical as part of the customer satisfaction, business performance and internal communication. The subject and content of this thesis was limited to management level of sales and operations planning process. This limitation was determined because S&OP process in its whole entity is very wide, and development of whole process would require very detailed development and possibly years of implementing.

In the theoretical part of this thesis is described the nature of electronic manufacturing industry, outsourcing of functions or manufacturing, and present and future market view together with the greatest global challenges of today. The theory of S&OP process is also comprehensively described.

The current state of the process and development areas were recognized by analyzing the responses received from company management through questionnaire and interviews with the results gathered from the performance indicators of the company. The research results gathered with the used research methods and the analyzes conducted based on these results were determined reliable.

A development proposal was made for the company by combining the relevant theory and literature with the current state analysis and recognized development areas conducted based on the research results. The development proposal was provided in the form of a broader S&OP process description. This form was determined to better describe the content of the development proposals and proposals impact for the whole S&OP process. The company was also provided with requirements for successful implementation and implementation related risks.

KEYWORDS:

Business processes, contract manufacturing, electronic industry

Tomi Koskinen

KYSYNNÄN JA TARJONNAN TASAPAINOTUS JA KEHITTÄMINEN

- Yritykselle Tepcomp Oy

Opinnäytetyön tavoitteena oli selvittää Tepcomp Oy:n kysynnän ja tarjonnan tasapainotukseen liittyvän prosessin nykytila, mahdolliset kehityskohteet sekä luoda yritykselle kehitysehdotus, miten prosessia voidaan kehittää ja miltä prosessi voisi näyttää tulevaisuudessa. Prosessi nähdään yrityksessä tärkeänä osana yrityksen koko toimintaa, mutta erityisesti tärkeänä osana asiakastyytyvää ja liiketoiminnan suorituskykyä sekä sisäistä kommunikaatiota. Opinnäytetyön aihe ja sisältö rajattiin kattamaan vain prosessin johtotaso, koska prosessi kokonaisuudessaan on hyvin laaja ja koko prosessin kehitys vaatisi hyvin yksityiskohtaista kehitystä ja mahdollisesti vuosien implementointia.

Työn teoriaosuudessa kuvataan elektroniikan sopimusvalmistus -toimialan luonnetta, toimintojen tai tuotannon ulkoistamista, sekä nykyhetken ja tulevaisuuden markkinatilannetta yhdessä tämän hetken suurimpien globaalien haasteiden kanssa. Myös kysynnän ja tuotannon tasapainotukseen liittyvän prosessin teoriaa on kattavasti kuvattu.

Prosessin nykytila ja kehityskohteet tunnistettiin analysoimalla kyselylomakkeella ja haastatteluilla yrityksen johtohenkilöiltä saatuja vastauksia ja yhdistämällä näitä yrityksen suorituskyvyn mittareista saatuihin tuloksiin. Tutkimusmenetelmillä saadut tutkimustulokset ja niiden perusteella tehdyt analyysit todettiin luotettaviksi.

Yhdistämällä aiheeseen liittyvää teoriaa ja kirjallisuutta tutkimustuloksien perusteella tehtyyn nykytila-analyysiin ja tunnistettuihin kehityskohteisiin, tehtiin yritykselle prosessin kehitysehdotus. Kehitysehdotus tehtiin laajemman prosessikuvauksen muotoon, jotta kehitysehdotukset ja niiden vaikutus koko prosessiin tulevat paremmin esille. Yritykselle toimitettiin myös kehitysehdotuksen onnistuneeseen implementointiin liittyvät vaatimukset sekä kuvattiin tähän liittyvät riskit.

ASIASANAT:

Elektroniikkateollisuus, liiketoimintaprosessit, sopimusvalmistus

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LIST OF ABBREVIATIONS (OR) SYMBOLS

CAGR	Compound annual growth rate
CEO	Chief executive officer
EMS	Electronic manufacturing services
ERP	Enterprise resource planning
IT	Information technology
KPI	Key performance indicator
MPC	Manufacturing planning and control
MPS	Master production schedule
S&OP / SOP	Sales and operations planning

1 INTRODUCTION

A well-managed sales and operations planning process linked to the company's strategy and business plan is recognized as a vital cornerstone for the company's success. Sales and operations planning is key in balancing demand and supply in the company's operations, and therefore it is an operation guiding process throughout the different levels and functions of the company. It is often said that every company, especially company that is doing well, has sales and operations planning process in place, sometimes unknowingly.

The top management of the target company, Tepcomp Oy, has recognized that their sales and operations planning process is not as effective as expected, and that there is room for improvement. It has also been recognized, that the cooperation of the company's sales and marketing and internal operations is frequent, but it could be developed to be more systematic and coherent. The target company is also looking for significant growth in the future, and they want their sales and operations planning process to be adaptable for the future growth. With more data available, and more systems to support cooperation and communication between people from different locations, it is critical to find the right ways and tools for a company to succeed. With the trend of globalization and increasing opportunity of remote work, it is also critical to find ways to support these trends and enable cooperation and fluent communication from every location. As sales and operations planning is a key part in the business success of the target company, it was seen by the top management that the process has a great opportunity for improvement.

The objective of this thesis was developing the sales and operations planning process of the target company. First objectives are to find out the current state of the process and possible improvement areas within the process, then to create a development proposal of how the process could be improved and what the process could look like in the future. The subject and content of this thesis was limited to the management level of sales and operations planning process. This limitation was determined because the S&OP process is a wide, cross-functional process, and changing the process all the way from the top management to the lower levels of the organization would require very detailed development and possibly years of implementing. By limiting the content of this thesis to

the management level, company will be provided a more high-level development proposal which can be adapted to their current business model and processes.

2 TEPCOMP OY

Tepcomp Group is one of the leading electronics manufacturing service companies in Finland. The company was originally founded in 1984. The original name of the company was Turun elektroniikkapalvelut Oy, and the company received its current name in the early 1990s. The company's headquarters is located in Turku, Finland. Tepcomp has factories in Turku, Finland and in Kuressaare, Estonia and separate sales offices in Sweden, Germany and also in Espoo, Finland. The company focuses in manufacturing health care technology, industrial electronics, and LED-electronics. The company operates in high mix / low volume -manufacturing sector, with capabilities to provide high volume manufacturing aswell. (Tepcomp Group 2021)

The company has around 135 employees and in 2020 had a turnover of 11,2 million euros. Tepcomp has more than 100 customers, most of them domestic but also many international companies from different industry sectors. With high mix / low volume production, Tepcomp delivers more than 5000 customer shipments, involving more than 800 different products and more than 7000 different materials on a yearly basis. Tepcomp's main market area is Europe, but they also have direct exports to Asia. (Tepcomp Group 2021)

Tepcomp's values are being customer-centric, having high operational quality and being precise. The company also strongly commits to the principals of sustainable development by having their environmental values and recycling as part of their everyday operations, and actively developing their operations to be more eco-friendly. For Tepcomp, economical and ecological efficiency are objectives that support each other. Tepcomp also has ISO9001 quality certificate, ISO14001 environmental certificate, and ISO13485 quality standard for medical devices to guide and support their values. (Tepcomp Group 2021)

The company's manufacturing service concept involves research and development, engineering services, manufacturing, and logistics. Manufacturing includes both circuit boards assembly and box building, and logistics include both incoming (sourcing) and outgoing logistics to the chosen sales channel. (Tepcomp Group 2021)

3 ELECTRONICS MANUFACTURING SERVICES

In the 1990s, contract manufacturers generally only manufactured components and partial assemblies, mainly focusing in the assembly of printed circuit boards. Forced by thin and shrinking margins in these activities, the contract manufacturers started to offer a broader range of services. Today, these contract manufacturers prefer to be called providers of Electronic manufacturing services (EMS), as this more accurately describes the broad range of activities they offer. The term EMS is generally used for companies providing a contribution in design, test, manufacturing, and distribution. Leading EMS companies now want to manufacture and test complete system; offer end-to-end solutions and manage entire supply chains, including services like:

- product design and engineering
- volume manufacturing
- final assembly and testing
- direct order fulfilment
- after sales product service and support
- and global supply chain management.

These services include purchasing the required components, engaging in testing services, prototyping, new product introductions, return and repair services, handling of logistics and end-of-life support. (Van Liemt 2007, 7-8; Adroit Market Research 2021)

3.1 Trend towards outsourcing

Around the world, large companies try to become smaller in terms of employment by relying on others to look after to some of their operations. Such operations could be catering, cleaning, external security, personnel management, IT services or logistics.

Outsourcing some of their activities help them to focus more on their core activities. Manufacturing was long seen as a core activity, and for some industries it still is. But for a growing amount of industries and companies, especially for sectors that require highly standardized processes and great differences in labour-, capital- and skill-intensiveness in different stages, outsourcing is globally increasing. Outsourcing also helps companies to spread the risks and lower costs, reduce their working capital, gain access to key technologies and adjust their production more flexibly by passing the burden of idle overheads to the subcontracting companies. For subcontractors, the advantages are that they can focus on production and that there is a low risk of not being paid for the work. (Van Liemt 2007, 3)

Outsourcing in electronics

Electronics companies are facing more intense pressure than before – product life cycles are shortening, speed and time are critical and resources are limited. The pressure on the margins is high, competition is fierce and market conditions are volatile. The highly competitive nature of the electronics industry, the ever increasing complexity and sophistication of electronics products, and the shorter product life cycles cause intense pressure to reduce costs, and lead to a rapidly growing demand for advanced manufacturing capabilities and related services. In the past, large companies could handle all these by themselves and remain competitive. In the current environment, it takes too much time and resources to be an expert at everything. Subcontracting to EMS providers allows companies to take advantage of the design, manufacturing and supply chain expertise of the EMS companies, and allows the electronics companies to balance their capital assets on their core activities – which often are sales, marketing and research and development. Subcontracting to EMS providers enables companies to:

- lower operating costs, reduce capital investments and other fixed costs
- improve inventory management
- reduce time-to-market and time-to-volume production for new products
- access world leading manufacturing technology and engineering capabilities

- optimize supply chain management
- produce the same product on a global scale by making use of parallel production facilities
- enhance purchasing power (EMS providers buy large quantities of components and other raw materials and by doing so receive volume discounts and other favorable terms from suppliers).

(Van Liemt 2007, 6-7; Fortune Business Insights 2021)

3.2 Global market

The global market of electronic manufacturing services has been growing with a compound annual growth rate (CAGR) of 7,5 percent in the past five years, exhibiting a lower growth of 6,5 percent in 2020 than in the past years. The global EMS market size in 2020 was around 470 billion USD. The global market share by electronics industry can be seen in figure 1. (Fortune Business Insights 2021; Sherman 2021)

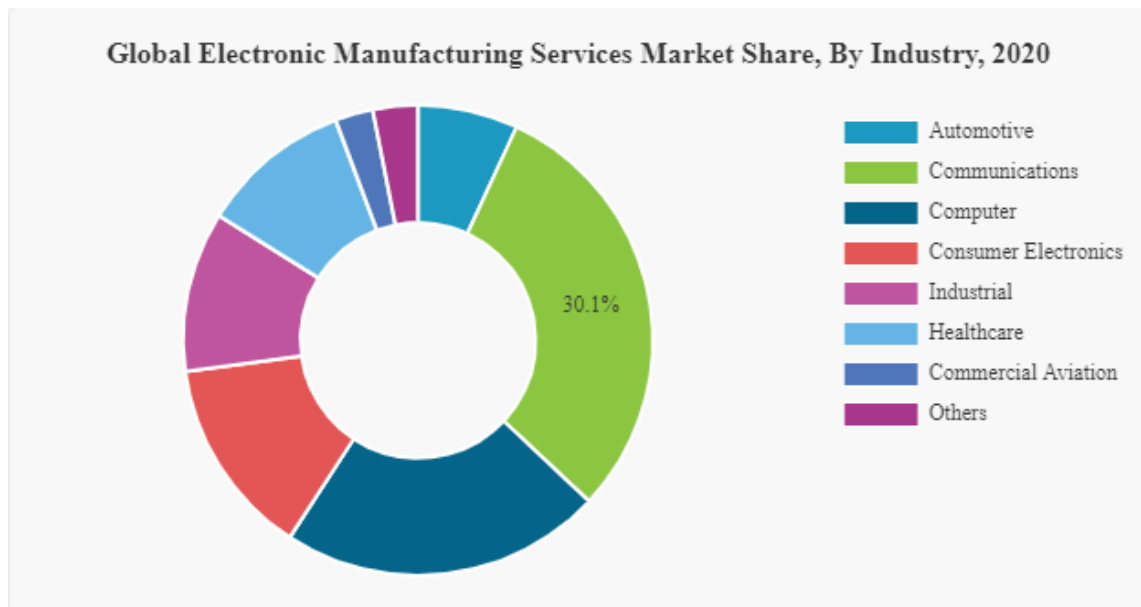


Figure 1. Global Electronic Manufacturing Services Market Share, By Industry, 2020 (Fortune business insights 2021).

The EMS market is primarily driven by increasing demand for electronic devices. Due to increasing connectivity among different products higher demand for novel features and

goods, ranging from audio products to wearables and even virtual reality, especially consumer electronics and automotive sectors are largely driving the market growth. Furthermore, policymakers globally are taking steps to increase electric car demand in order to reduce fuel consumptions and pollution-related problems, for example:

- European countries are already focusing their efforts on eliminating diesel-combustion and gasoline engines by 2030 and building an efficient electric vehicles framework
- Indian government has chosen 11 cities across the country to pilot electric vehicles in their public transportation systems

Such initiatives by governments boost the market growth. The global expansion of EMS market is further supported by expanding manufacturing industry across nations. In the next 5 years, from 2021 to 2026, the EMS market is expected to register a CAGR of 8-10 percent. The corona virus – COVID-19 – pandemic might be halting or delaying the market growth, but once the pandemic is over researches suggest the growth to be returning to the forecasted levels. In terms of geography, the market is segmented into North America, Europe, Asia Pacific, the Middle East & Africa, and South America. Currently, the largest market is North America, but the fastest growing market is Asia Pacific. Growth rate by region can be seen in figure 2. (Adroit Market Research 2021; Fortune Business Insights 2021; Mordor Intelligence 2021).

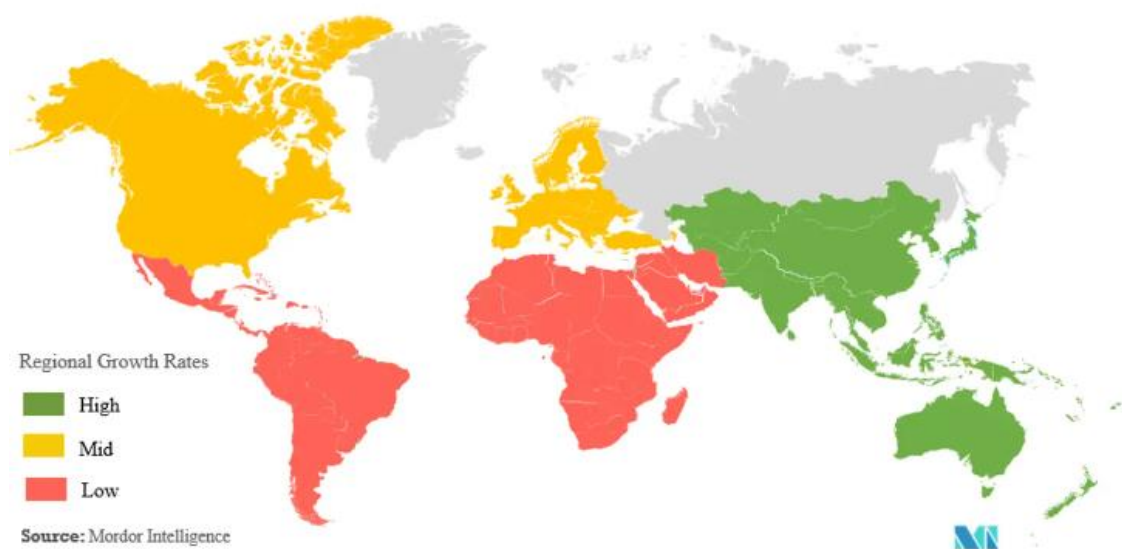


Figure 2. Electronics Manufacturing Services Market – Growth Rate by Region (2021 – 2026) (Mordor Intelligence 2021).

3.3 Impact of Covid-19

The global electronics industry has been severely affected by the Covid-19 pandemic. Starting from the first quarter of 2020, the widespread supply chain disruptions – stringent lockdowns imposed in many parts of the world – caused by the pandemic has caused halt and delay in the raw materials. Especially the transportation sector (automotive and aerospace), but also certain consumer electronics, have been negatively affected due to fear of travel and decline in disposal income. Already in 2020, many major automakers including Fiat, Volkswagen, PSA Group, General motors and BWM had to halt their production because of the supply chain disruptions. This scenario has on impact on the global EMS market, especially European countries, since the growth of European market is associated with the demand for electronics in developed economies. For contract manufacturing services market the impact has been declines with regard to orders. According to surveys conducted by the Organization for Economic Co-operation and Development (OECD), in March and April 2020, 43% global electronics manufacturers and suppliers are negatively affected due to Covid-19. (Fortune Business Insights 2021; Sherman 2021)

In late 2020, the Covid-19 effects on worldwide automotive semiconductor supply escalated, causing bottlenecks in the supply which rapidly evolved into a global chip shortage. In the late 2021, the crisis is having negative impact for 160 industries, and the market watchers estimate that event will cost 110 billion dollars in revenue in 2021 for the vehicle sector alone. Multiple analysts and top semiconductor and electronics manufacturers – such as Intel, Flex, and Taiwan Semiconductor Manufacturing Company (TSMC) – expect the chip shortage to continue into 2023. In October 2021, the lead times of Intel and Advanced Micro Devices (AMD) data center and server ICs had grown to 45 to 66 weeks. The chip sector is responding to the crisis by increasing capacity, but modern factories take years to build up and equip, so significantly ramping up production is difficult. (Supply Chain 24|7 2021)

At the same time, the Covid-19 has driven some positive effects to certain electronics markets. As the pandemic has forced people to work remotely and spend more time at home, the demand for computers and laptops has increased, driving the competition for

electronic manufacturing services in computer applications in the longer term. (Fortune Business Insights 2021)

Strategies to fight the component shortages

Often great challenges bring a chance for great opportunities. Electronics manufacturers have a couple of ways to cope with the poor availability of components. These coping strategies can be grouped into three different innovations:

1. **Technological innovation.** One way to get around the supply chain disruptions is being creative and smart with product designing. For existing products, product redesign becomes a very effective way to create alternatives to critical parts. New products on the other hand should be designed with alternatives for critical components in mind, as having as many alternatives as possible lowers the risk for future supply chain disruptions compared to having single source components.

With the global shortages the risk of buying fake components from the market significantly increases. Because of this, creating or having component quality inspection systems that enable “zero-trust” traceability approach becomes critical in detecting counterfeits or other quality issues.

Another way to lower the risks in the supply chain is to increase market intelligence. One effective way is to create software and tools to track supply chain disruptions before company’s own operations are affected.

2. **Operations innovation.** Some critical components are not available anywhere on the market, which makes stronger inventory and pipeline management extremely important. Bringing more providers into company’s supply chain increases the chance of acquiring components that are needed, and encouraging customers to adopt longer planning horizons secures the component pipelines for the future. Electronics manufacturers need to also strive for increased flexibility in their production processes, accommodating shifts and product changes according to material availability.
3. **Ecosystem innovation.** The industry leaders believe that flexibility and adaptability are best achieved at the level of industry ecosystem. In order for

every stakeholder to factor in full set of information and uncertainty and be able to plan more effectively for the longer run, closer and more transparent communication with suppliers, partners and customers are needed. Closer collaboration helps to maintain strong relationships with key suppliers, and builds trust with customers. (Annunziata 2021; Supply Chain 24|7 2021)

All these coping strategies require use of software analytics and strong handling of data. There is a great chance that these three strategic innovations spurred by the current supply chain disruptions could also have long-lasting positive impacts on efficiency and flexibility of the industry. (Annunziata 2021)

4 SALES AND OPERATIONS PLANNING

Sales and operations planning (S&OP) has been used for years but origins of the term are unclear. Sales and operations planning process was first published in Richard C. Ling's and Walter E Goddard's book "Orchestrating Success: Improve Control of the Business with Sales and Operations Planning" in 1988. Both material requirements planning (MRP) and manufacturing resource planning (MRP II) systems have been important precursors in creation and development of the S&OP process. (Sheldon 2006, 1; Feigin 2011, 69; Parravicini 2015, 167)

S&OP is a top-management planning process which can and should be used in any business that manages demand and synchronizes resources. Usually, if a company is doing well it must have some kind of sales and operations planning in place, sometimes unknowingly. S&OP is in some cases also referred to as sales, inventory, and operations planning (SIOP). (Sheldon 2006, 3; Feigin 2011, 69)

4.1 Definition

In the simplest terms, sales and operations planning is a cross-functional business process used by the top-management to balance demand and supply in order to operate profitably. S&OP occurs at different levels within the company, involving company's general management, sales, operations, finance, human resources and product development departments. The process is used to integrate marketing, sales, operational and financial planning and to link company's strategic plans with its operations. S&OP process is about coordinating and synchronizing responses to close, unforeseen events – like supply or resource shortages – and also anticipating future outcomes so that the company is best positioned to benefit from expected, and unexpected, future events. Sales and operations process is not a general model company can just implement – each company needs to tailor the process to the specific constraints the company has to contend with. (Feigin 2011, 71; Logistiikan Maailma 2021; Parravicini 2015, 167-168)

The key to successful S&OP is preparation, effective data mining (both past and future data) and analysis followed by risk assessment and finally decision-making. The importance of having all departments to work towards a realistic sales and operations

plan that everyone can understand and agree with is also emphasized as a key factor in S&OP success. (Parravicini 2015, 167-168; Sheldon 2006, 3-4)

4.2 Linkages & Fundamentals

Sales and operations planning provides key communication links for top management to coordinate and integrate financial planning, marketing planning, sales planning and operational (resource) planning. The purpose with coordinating these planning activities is to link the company's strategic plans with its operations. For example, marketing team can be releasing a new product to the market, which can be coordinated with an increase in manufacturing capacity to support the marketing objectives, and at the same time financial resources need to be coordinated to support the working capital for the increasing inventory or new production lines or equipment. The key linkages between different planning activities are shown in figure 3. (Jacobs, Berry, Whybark & Vollmann 2011, 88-89; Parravicini 2015, 168-169)



Figure 3. Key linkages in Sales and Operations Planning (Jacobs, Berry, Whybark & Vollmann 2011, 89).

From manufacturing perspective, S&OP provides the framework for developing the master production schedule (MPS). The master production schedule is the main driver for requirements in an Enterprise Resource Planning (ERP) system in manufacturing companies. This schedule provides signals for procurement and manufacturing requirements. MPS is a detailed schedule in the ERP system that drives inventory levels,

supply chain actability, customer service, and machine and capacity utilization. This master production schedule is usually the responsibility of master scheduler, which dictates the requirements from customer demands. Creating MPS may sound simple, but there is often known and unknown demands that should somehow be taken in to account. Known requirements are usually firm orders from customers. Unknown requirements could either be planned requirements that were never met or a sudden increase in demand. Known and unknown requirements are presented in figure 4. In order to meet the company's strategic business objectives, material resources and plant capacities are then coordinated based on the MPS decisions. (Sheldon 2008, 91-94; Jacobs, Berry, Whybark & Vollmann 2011, 89)

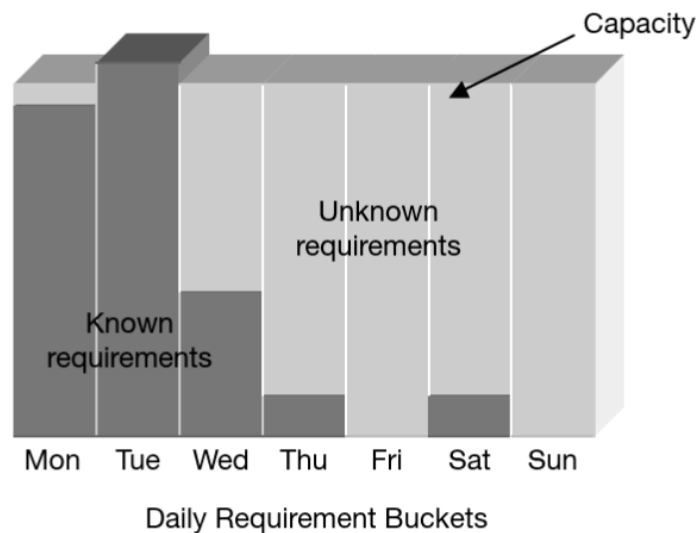


Figure 4. Known and unknown requirements in master schedule (Sheldon 2008, 94).

Sales and operations is usually divided into four different fundamentals – demand, supply, volume and mix. The balance between demand and supply is extremely important, and it is often said that not matching supply with demand can make or break any business. In the case of demand exceeding supply, in example manufacturing cannot provide the volume required, usually customer service suffers and costs increase because of working overtime and using premium freight rates. Also the rush to ship the products may affect quality, which causes more additional costs. On the other hand, if supply exceeds demand, it usually increases inventories, production rate cuts (possible layoffs) and weakens profit margins because of price cuts and discounting. All of these cases are unfavorable for the business. The two other fundamentals, volume and mix,

need to be treated separately in managing the manufacturing planning and control function. Volume concerns rates and levels – production rates, inventories, overall sales rates and order backlogs, and big-picture decisions about the production rates for product families and how much to make. Mix concerns more detailed decisions – which individual products to make, for which customers and in what sequence. Often companies focus on mix decisions because of the current customer pressures, which leads them to focus in predicting mix, instead of focusing on the big picture. When companies plan volume first, they realize that the imbalance in demand and supply happens frequently in the course of a year, and therefore the need for reviewing and adjusting volume decisions only needs to be done on a monthly basis. Planning volume first also makes mix decisions much easier to deal with. Balancing demand and supply at the volume level is the role of sales and operations planning. This can be done through effective coordination of the plans of different functional areas together with active involvement of top management. (Jacobs, Berry, Whybark & Vollmann 2011, 88-89)

4.3 Process

Sales and operations planning is a monthly, or sometimes weekly, process that enhances information sharing and coordinating of plans across the organization to calibrate the execution with the strategic plans of a company. Both customer expectations and internal operations are reviewed for process accountability, accuracy, and future risk management. The plans are monitored, reviewed and updated if needed. Since the process is cross-functional, it usually involves company's general management, sales, marketing, operations, finance and sometimes product development or human resources. (Sheldon 2006, 2; Parravicini 2015, 169; Kolassa & Siemsen 2016, 130)

4.3.1 Planning cycle

In practice sales and operations planning process usually has three key elements to it:

1. Demand forecasting and planning. This includes utilizing history data as well as estimated future demand.

2. Supply planning. This means reviewing material availability and different capacities affecting deliveries – in example manufacturing or transportation capacity.
3. Balancing measures if demand and supply do not meet. Balancing act could be for example trying to increase sales through campaigns or pricing, or increasing supply by increasing capacity. (Logistiikan maailma 2021)

These three key elements form the basis for the monthly, typically five-step S&OP process. From the start of the planning cycle to the end, the five steps of the process are data gathering, demand planning, supply planning, pre-SOP meeting and executive SOP meeting. The cycle and the five steps together with the functions responsible for each step are presented in figure 5, and further described later in this chapter. (Jacobs, Berry, Whybark & Vollmann 2011, 94; Kolassa & Siemsen 2016, 130)



Figure 5. The monthly sales and operations planning process cycle.

Step 1: Data gathering

The process cycle begins with data gathering, step that occurs shortly after the month end. Typically the data involves the actual sales, production, inventories, etc. from the past month. Often the up-to-date information from the month just ended can easily be taken out from an enterprise resource planning or other information technology (IT) system. This data is then disseminated to the appropriate people. If the data is not easily available from an IT system, then it is common that representatives from different functions share relevant information with each other. This information works as a basis for marketing and sales people to use in developing sales analysis reports, and changes to sales forecasts. (Jacobs, Berry, Whybark & Vollmann 2011, 94-95; Kolassa & Siemsen 2016, 130)

Step 2: The demand planning phase

The information received in step 1 is reviewed by sales and marketing and discussed with a view of generating a new forecast. As an outcome of this step the team agrees on a new or updated consensus forecast, which is often used to develop sales targets for the sales function. If the sales targets are developed through consensus forecast, it is critical to notify a possible conflict here. Marketing and sales people might have an incentive for lowering the forecast, because it is an easy way to make their objectives more obtainable. On the other hand, they might also inflate the forecast, since they know that will push operations to make more products available, therefore decreasing the chances for a stockout and increasing sales-related bonuses. (Jacobs, Berry, Whybark & Vollmann 2011, 94-95; Kolassa & Siemsen 2016, 130-131)

Step 3: The supply planning

In this phase all capacity and resource planning takes place. Production, capacity, inventory and procurement decisions are made according to the updated forecast. Operations plan might need to be modified, if for example demand exceeds supply by a too large margin, or because of shortages the prioritization policies need to be developed. If operations plan needs a change, often the changes need to be authorized by the top management. Also if major risks are notified, contingency plans need to be developed. These type of issues are usually carried into the pre-SOP meeting. (Jacobs, Berry, Whybark & Vollmann 2011, 94-95; Kolassa & Siemsen 2016, 130)

Step 4: The pre-SOP meeting

Fourth step is the pre-SOP meeting. In this meeting, the representatives from different functions (senior management) make decisions regarding the balance of demand and supply. In particular, the finance function sometimes has a veto power to enable better cash flow planning and investor communications. Other actions that need to be discussed in this phase is resolving problems where differences in recommendations exist, developing alternative courses of action, identifying areas that cannot be resolved in this meeting (which are to be discussed in the executive SOP meeting), and setting the agenda for the executive SOP meeting. The meeting also involves a review of the plans and recommendations for each product family grouping, the development of an updated financial view of the business, and recommendations for changes in operations plan and regarding alternatives to be discussed in the executive SOP meeting. (Jacobs, Berry, Whybark & Vollmann 2011, 95-96; Kolassa & Siemsen 2016, 130)

Step 5: Executive SOP meeting

The fifth and final step is the executive SOP meeting. This meeting is the culmination of each month and involves the company's top management – senior executives. The purpose of this meeting is to discuss and finalize all relevant plans. In more detail, the purpose is to review customer service and business performance, to make decisions on the sales and operations plan for each product family, authorize spending for changes in operations plan (production and procurement rate changes), relate the collective impact of sales and operations plans to the overall business plan and resolve the areas which the pre-SOP team represented. Below in picture 1 is presented a sample agenda for executive SOP meeting. (Jacobs, Berry, Whybark & Vollmann 2011, 96; Kolassa & Siemsen 2016, 130)

1. General business review:
 - a. Customer-service performance
 - b. Financial performance
 - c. Aggregate review of sales plan, manufacturing plan, and engineering plan
2. Review of business plan assumptions
3. New projects update:
 - a. New product developments
 - b. Supply chain and enablers
4. Family by family review:
 - a. Sales forecast
 - b. Gap filling activities
5. Channel-/customer-specific activities
6. Production/procurement rate changes
7. Recap of meeting decisions and expected impact on the business plan
8. Critique of the S&OP meeting and process.

Picture 1. A sample agenda for executive SOP meeting (Parravicini 2015, 185).

Sales management perspective

In his book “A guide to Sales Management: A Practitioner’s View of Trade Sales and Organizations”, Parravicini (2015, 169-170) describes the sales and operations planning process to be a ten step cycle. These steps are more focused in viewing and describing sales and operations planning from the sales management point of view. The ten steps, as presented in figure 6, are:

1. Updating the sales forecasting system
2. Sales forecasting
3. Sense checking the sales forecast
4. Identifying gaps versus annual operations plan
5. Planning gap filling activities
6. Checking feasibility and financial viability

7. Gaining approval of the plan
8. Updating the planning system
9. Measuring process of effectiveness
10. Identifying improvement areas

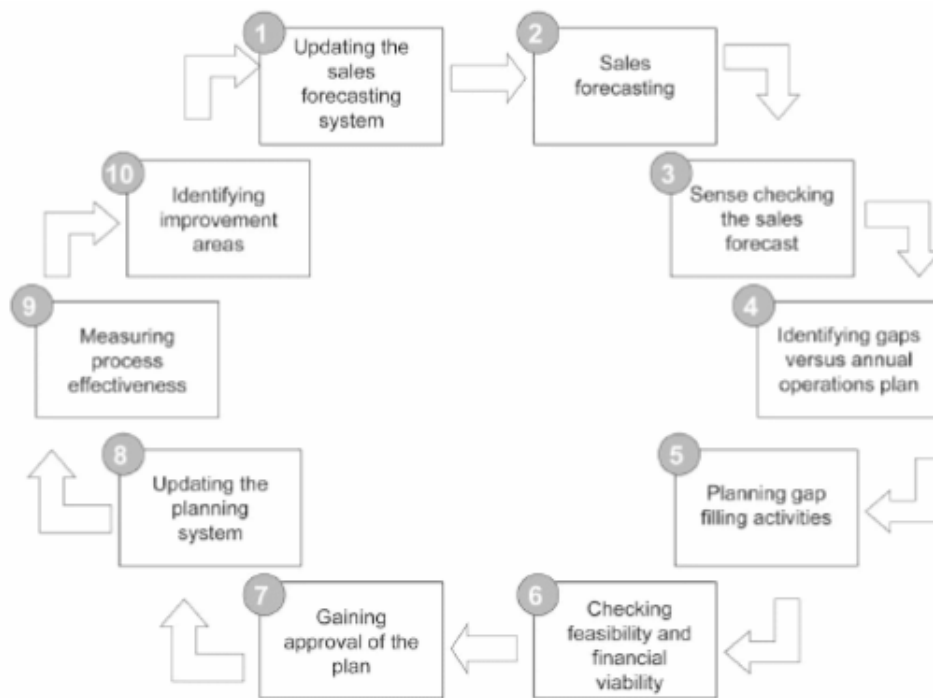


Figure 6. Sales and operations planning key steps (Parravicini 2015, 171).

Step 1: Updating the sales forecasting system

For the top management of the company, sales forecast can be presented with a simple one page presenting the main figures. For the operating level, there needs to be a clear, detailed system to record the sales forecast in volume or unit, divided to product families, subfamilies, sales channel and / or customer. The system needs to be regularly updated with list prices, new product lines and deleted items. (Parravicini 2015, 170)

Step 2: Sales forecasting

The sales forecast should include the next eight quarters, so that the short-, mid- and long-term evolvement can be seen. The sales team has a lead role especially in short-term forecast, but usually the mid- and long-term forecasts are marketing team's responsibilities. No matter which is whose responsibility, these departments need to work

together. Short-term forecast is usually one to three months but it can in some businesses be up to six months. Mid-term forecast from four or seven to 12 months and long-term is from 13 to 24 months out. The details of the forecast also vary based on the time horizon. The short term forecast needs to be the most detailed. Sales forecasting and the detail level of short, mid and long-term are presented in figure 7. (Parravicini 2015, 170-172)

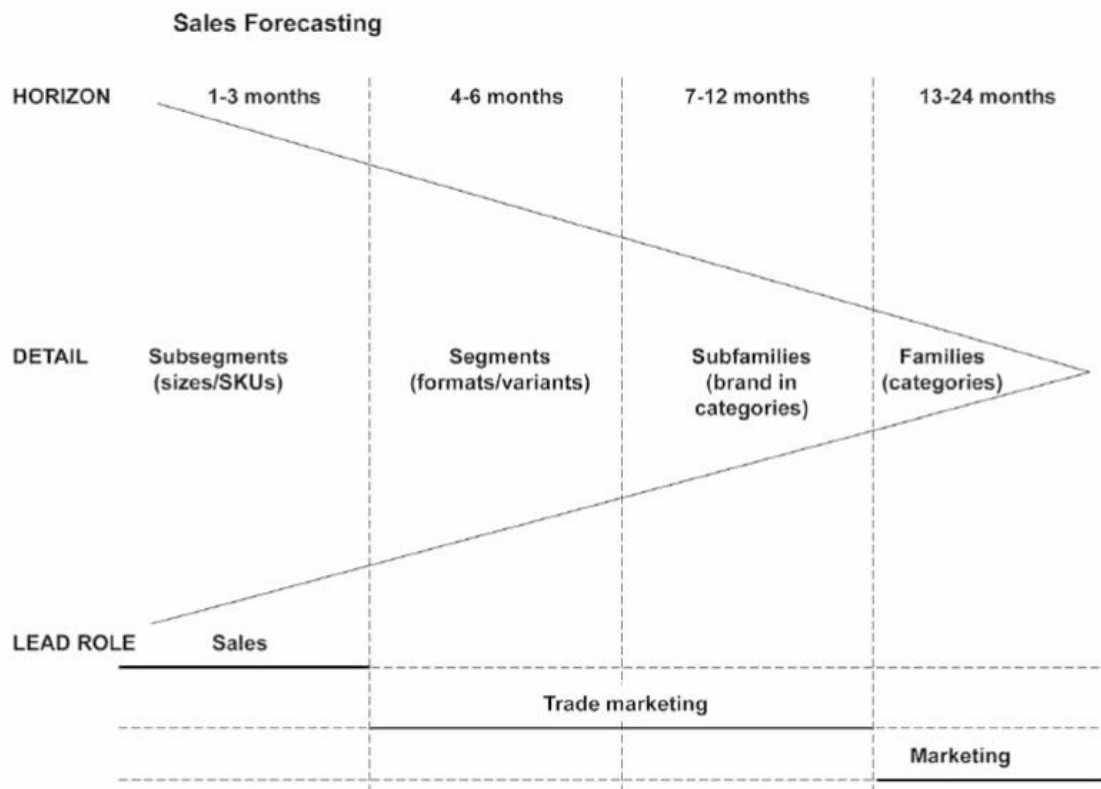


Figure 7. An example of sales forecasting framework (Parravicini 2015, 172).

The sales and marketing team will usually prepare two different kinds of sales forecasts – a very optimistic to pass for the planning team and a very pessimistic forecast to plan to their line managers. The planning team will make their own forecast based on the sales forecast provided for them, and bring the supply side knowledge – manufacturing capacity, lead times, etc. – to the process table. Also finance team will develop their own sales forecast. Normally finance team utilizes history data and apply a certain pattern to forecast sales. This step is concluded once all the departments have prepared their forecasts and reconciled them into a consensus forecast. (Parravicini 2015, 171-174)

Step 3: Sense checking the sales forecast

In this step all the forecasts from different functions need to be checked and the gap between them has to be minimized. The sense checking is done by comparing the forecasts of all the departments and challenging their assumptions. The company's middle management will eventually decide a minimum percentage gap that they accept in the forecast, and then conclude and sign off a consensus range forecast. (Parravicini 2015, 174-175)

Step 4: Identifying gaps versus annual operations plan

The turnover matrix by product family and by sales channel in the consensus forecast needs to be compared with the company business plan included in the annual operations plan. There will always be some mismatches even at the top level, so it's important for the company's middle managers to identify the areas of underperformance and plan corrective actions. (Parravicini 2015, 175)

Step 5: Planning gap filling activities

Once performance gaps have been sorted out, more gap filling activities need to be done in the form of design solutions. This step can generate internal competition between account managers and brand managers in tackling product family and sales channel issues. Sales and marketing teams need to generate and coordinate ideas to select and prioritize alternatives. These alternatives can mean customer specific promotions or bringing forward a new product launch. (Parravicini 2015, 175)

Step 6: Checking feasibility and financial viability

This step is about checking that the planned gap filling activities can, or are wanted to be carried out. There are a number of checks to be performed before preparing a short list of gap filling activities for the approval of the company's board of directors. For example, it has to be confirmed that the products can be manufactured on time and that the gap filling activities are also financially appealing. (Parravicini 2015, 176)

Step 7: Gaining approval of the plan

The company's functional directors should convene in a formal S&OP meeting at least once a month. The board will either approve the plan partially or in full, and present the plan with recommended corrective actions to the company's chief executive officer (CEO). After CEO's approval the outcome of the discussion becomes the new plan. (Parravicini 2015, 176)

Step 8: Updating the planning system

The planning system is updated based on the decisions taken in the S&OP meeting. In some cases the planning system is updated couple of times during the cycle – after receiving the detailed short-term forecast and then again after the agreement of the consensus forecast. The other option is to wait and update the planning system only after consensus forecast has been done. (Parravicini 2015, 176)

Step 9: Measuring process of effectiveness

At the end of every sales and operations cycle, performance should be measured through a number of easy access metrics (Parravicini 2015, 176).

Step 10: Identifying improvement areas

S&OP process should be overlooked critically at the end of each cycle to identify improvements for the following S&OP cycles. This step is led by the company's board. (Parravicini 2015, 177)

4.3.2 The prerequisites of S&OP and new management obligations

In order to implement and maintain an effective S&OP process, there are some necessary prerequisites that have to be cross-functionally brainstormed and agreed. The prerequisites play a key role in enabling smooth and effective S&OP process, and increases the chances of achieving the goals set for the S&OP process.

Understanding of the S&OP process

All the stakeholders must have a clear understanding of what S&OP process is and how it works, what are its principles and benefits. Company's executive management must formally establish and sign the S&OP policy, describing the purpose of the process and its schedules, participant, product families, time horizon, time fences, and review. Because people also learn by doing, it might be good to start S&OP by piloting with a couple of product families with different characteristics before moving into full mode. (Parravicini 2015, 181)

Assigned responsibilities

All managers and directors must know exactly what is expected of them and their colleagues. Implementing sales and operations planning requires major changes in top management coordination of functional activities, as the top management needs to provide the direction for the business. This means that the top management's obligation is to commit to the process and establish a framework for the S&OP planning. One of the board members will be assigned to support the S&OP project manager and the core implementation team that includes the middle managers. This team will set up the S&OP demand and supply planning subteams, organize the meetings that support the S&OP cycle, imply modifications of performance measurement and reward structures with the S&OP plan and prepare the S&OP policy, education and training to be approved by the board of directors. Once S&OP has become an established process rather than project, this team will also be responsible for its review, maintenance and improvements. (Jacobs, Berry, Whybark & Vollmann 2011, 105-107; Parravicini 2015, 181)

Top management's overall active participating and follow up once the process is established is necessary. Part of the commitment is to force a resolution of trade-offs between functions. The sales and operations plan provides a great, transparent basis for resolving conflicts – basic implications of alternative choices. If these conflicts are not handled at this level, it will force operating people to make mixed day-to-day decisions, perhaps unfavorably. The top management must encompass all sales and operations activities related formal plans – in example not let budgeting be a separate activity from the S&OP process, and lead the cultural change to make it happen. (Jacobs, Berry, Whybark & Vollmann 2011, 107)

In order to have a cross-functional team with appropriate skills in the S&OP process, there are six areas of roles and responsibilities to be addressed:

1. *Executive champion/sponsor*. This role needs to be filled by a senior executive in the business – either the president or a senior executive with a solid working relationship with the president. This role's responsibility is to clear major obstacles, acquire necessary resources and keep top management focused on the process.

2. *SOP process owner*. This person needs to have the capability to lead the implementation effort and provide the leadership for S&OP-process. A well-organized person with good people skills is a good choice.
3. *Demand planning team*. A typical team includes people from the following titles: forecast analyst, sales manager, salesperson, customer service manager, product manager, demand manager, new products coordinator, and S&OP process owner.
4. *Supply planning team*. This team typically involves the following roles: master scheduler, plant manager, purchasing manager, materials manager, production control manager, new products coordinator & S&OP process owner.
5. *Pre-SOP team*. This team could include: forecast analyst, product manager, master scheduler, demand manager, materials manager, customer service manager, plant manager, purchasing manager, controller, new products coordinator, and S&OP process owner. Critical for this team is to provide effective cross-functional skills.
6. *Executive SOP team*. This group should include the president, vice president of sales, marketing, operations, product development, logistics, finance, human resources, and the S&OP process owner. (Jacobs, Berry, Whybark & Vollmann 2011, 107-108)

The primary obligation under sales and operations planning is to follow the plan for all functions – manufacturing, sales, engineering, finance, etc. A secondary target is to communicate when something is preventing from hitting the plan. The purpose of monthly planning cycle is to facilitate cross-functional communication. The cycle ensures that critical issues and important trade-offs are considered on a routine basis, and the executive SOP meetings ensure that decisions to resolve these issues are made. (Jacobs, Berry, Whybark & Vollmann 2011, 107)

Time commitment

People commit their resources and prioritize S&OP-related work, and recognize S&OP is the key dynamic performance management process of the company. People also acknowledge the minimum frequency of S&OP cycle is monthly. (Parravicini 2015, 182)

Product families and unit of measure

One cross-functional issue is related to product family grouping, and determining how many of them there should be in developing S&OP process. Six to twelve product families appears to be the best number, more than twelve involves getting too much into detail and losing top management attention during the monthly meetings. In figure 8 is shown a range of possibilities to consider in defining product family groupings. At the top level of the pyramid there is not enough accuracy on which to base the demand-supply decisions. Likewise, at the bottom of the pyramid there is too much detail, and it will be difficult to see an overall picture of volume. (Jacobs, Berry, Whybark & Vollmann 2011, 108-109)

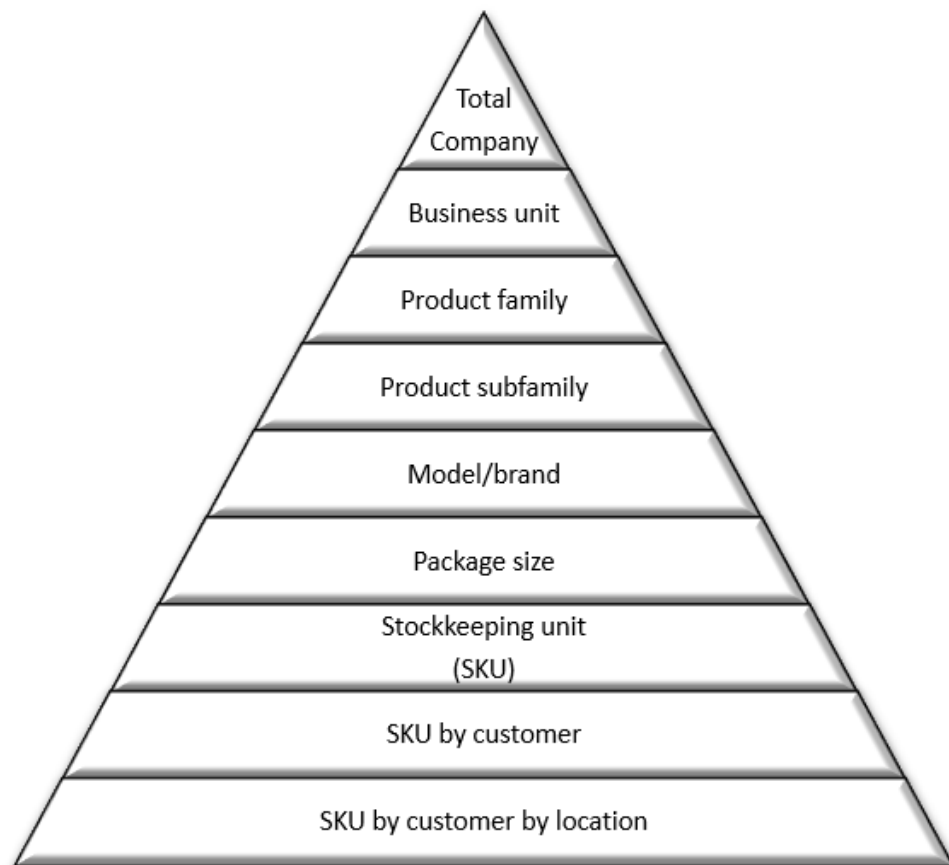


Figure 8. Product family grouping (Jacobs, Berry, Whybark & Vollmann 2011, 109).

Another problem in defining product families is to find a way to structure them in a way that is convenient for all different functions in the business. Some possibilities include

structuring the product family groupings by brand, market segment, customer, product type, product size or product characteristics. Setting up the product family groupings in a way that is consistent with how the marketing and sales people see the market is the best. Setting product family groupings lined up with the market segments or customer groups however, often does not line up with the resources – plants, processes and departments. Product families that make sense for all functions must be agreed upfront. Also, no time should be wasted in translations data from one unit measure to another, so a common cross-functional unit of measure need to be agreed – units, cases, kilograms, liters, etc. (Jacobs, Berry, Whybark & Vollmann 2011, 108-109; Parravicini 2015, 182)

Planning horizon

The planning horizon must allow a short-, mid-, and a long-term view. The minimum recommended view is a 12-month rolling horizon. Long-term S&OP plan can be linked to long-term financial and brand planning. (Parravicini 2015, 182)

Time fences

Theoretically, the rates of output of any supply plan can be increased in any moment in time. In practice, this is not always possible economically, as capacity and materials might not be readily available at standard cost. The feasibility of changes vary by product family, and are usually time dependent. Therefore, company should introduce time fences, determining the level of changes to plan that can be accepted for each product family. As a result, there will be a frozen time period in which changes are impossible or hardly possible to implement, trading periods where changes can easier be implemented to some extent, and an open period where every option is considered possible. Time fences could be in example:

Current month:	no change
Month 1-2-3:	+/- 25 percent
Month 4-5-6:	+/- 40 percent
Month 7 and beyond:	open

It is very possible that in the same business product families have very different time fences; some are very unfenced, in example no change for 14 days out, while some are very protected, in example no change for many months out. (Parravicini 2015, 182-183)

Data and IT tools

There are couple of issues that when solved, will help the process. First issue is information technology support. Forecasting and planning must be supported by IT tools. Most often the sales and operations planning process is carried out with electronic spreadsheets, and that is why having a person with appropriate level of spreadsheet skills in the team will help. Reliable and up-to-date data are fundamental to run sales and operations planning. Cutoffs for data processing and updating the system with actuals must be straightforward. (Jacobs, Berry, Whybark & Vollmann 2011, 108; Parravicini 2015, 183)

Another cross-functional issue is related to the budgeting process. The process of budgeting usually needs to be integrated with sales and operations planning. Budgeting is often on an annual basis, using data that aren't part of the manufacturing and planning (MPC) system or ERP system. This data usually isn't as accurate as the data in MPC or ERP database, and with the right use of MPC or ERP the data won't need to be collected – it always exists in up-to-date form. Therefore, doing budgeting and S&OP with the same underlying dynamic database enables the company to perform detailed variance accounting and cross-checking transaction accuracy. (Jacobs, Berry, Whybark & Vollmann 2011, 109)

4.3.3 Principles of S&OP

Massimo Parravicini (2015, 177-180) represents 12 principles, that should be kept in mind for implementing and maintaining effective sales and operations planning process:

1. *S&OP is an integrated cross-functional planning and decision-making process.*
In a well-structured S&OP process there is a better management of conflicts, because everybody understands when and where decisions will be taken, and decisions are made taking into account and balancing multiple views. S&OP is an integrated way of running a business by balancing demand and supply to

come up with an update of the company business plan, and this requires the participation of all functions. To avoid any duplication of tasks and meetings, S&OP is integrated with any other existing decision-making process.

2. *S&OP is led by the company's CEO/general manager.*

The head of business leads the sales and operations planning process. With the full support of the leadership team, the CEO/general manager takes on responsibility for the S&OP process output. A company board member is assigned to be responsible for driving the process and its improvement with the help of a cross-functional team. The leadership team leads by example by prioritizing time and resources to be dedicated for the S&OP process.

3. *Sales and marketing own the sales forecast.*

Sales and marketing are the only that can provide the customer and market intelligence needed to update the demand plan, and that is why they own the sales forecast. Other functions – planning, manufacturing, engineering, finance, etc. – support or challenge the sales forecast.

4. *Sales forecast is unconstrained.*

Capacity or material procurement limitations, such as foreseen risks, potential shortages, or manufacturing issues, should not constrain the sales forecast. This does not mean that there are no time fences in place for changing rates of output, but these should not be influencing the sales forecast.

5. *The forecast is not the target.*

The risk of confusing forecast and target is higher in marketing teams than in sales teams. Marketing team often leads the mid- and long-term forecast, and can be tempted to make a conscious decision to confirm an achievement of a target and leave things as they are until the next S&OP cycle, without taking into account the change on the market conditions. This basically amounts to hiding a problem and postponing the search for a solution. Good S&OP marketers are usually those, who very often say that they confirm the plan.

6. *Assumptions are documented and reviewed.*

In order to be able to periodically review all the assumptions, it is highly recommended to document clearly all the assumptions behind all the plans – sales plan, manufacturing plan, finance plan, etc. – that are shared and compared during the S&OP process. It is often more reasonable to question the assumptions rather than the numbers of a plan. An integrated, well run sales and operations planning process results in aligned assumptions.

7. *The outcome of S&OP process is a range forecast.*

At the end of every S&OP cycle the company agrees a range forecast. This forecast is used as basis to generate new business plan and targets. To support learning and accountability, all risks, opportunities and assumptions of this plan will be recorded for future reference and for comparison with actual results.

8. *S&OP is not about firefighting.*

In a good S&OP process, the current month is being less discussed and the time is more spent considering other months and quarters in the future. The focus is balanced to tackle and resolve issues with an appropriate lead time. The executive level of the company focuses more on a longer horizon, while middle management handles the short- and mid-term issues through an agreed process. Trade loading at month end and creating a sales pattern that is repeated over and over each month should be avoided.

9. *S&OP prerequisites are in place.*

All the S&OP prerequisites – described more detailed in chapter 4.3.2. – are cross-functionally agreed and everyone has the same understanding of the process.

10. *S&OP is a disciplined process.*

An effective S&OP process requires a teamwork mindset encouraged by the executive team. People need to feel trusted and empowered to take decisions and make proposals. Leaders on the other hand, expect discipline and transparency – meetings are held on time and by the right people, meeting agenda and information packs are reviewed by attendees prior to meetings, actions coming out of the meetings are clear and all key participants have S&OP in their workplans with shared metrics and targets.

11. *S&OP process metrics are in place.*

Cross-functionally agreed key performance indicators (KPI's) are in place to monitor the process performance. KPI's are reviewed as an integral part of the process and actions are taken with clear owners and carried out with a follow-up process.

12. *S&OP is a continuous improvement process.*

S&OP is supported by continuous improvement – responsibilities, discipline, documentation and overall quality and performance of the process need to be periodically assessed and needed changes agreed and performed.

4.3.4 Inputs and outputs of the process

Like all processes, sales and operations planning has certain inputs and outputs in the process. The input side emphasis on sharing relevant information about the demand forecast. From the marketing and sales side the inputs are such as product launches, acquisitions of new customers, forecast for active products and all similar kind of information that might help others in the process. At the same time, operations need to share input data as well, such as current inventories, capacity available and possible hick ups that might occur in example in acquiring parts for the products. On the output side are coordinated plans that use the earlier shared information as input. Each function creates their own plan, marketing develops a marketing plan, operations develop a production and procurement plan and finance develops a cash flow plan. These outputs are then shared and coordinated with others to ensure smooth and efficient operating in all functions of the organization. (Kolassa S. & Siemsen, E. 2016, 129-130)

From manufacturing perspective, as an output the S&OP provides the framework for developing the master production schedule (MPS). In order to meet the company's strategic business objectives, material resources and plant capacities are then coordinated based on the MPS decisions. (Jacobs, F. R., Berry, W. L., Whybark, D. C. & Vollmann, T. E. 2011, 89)

4.4 The S&OP performance indicators

The performance of the sales and operations planning process, just like any other business process, should be measured and process continuously improved. Many of the company's KPI's reflect the effectiveness of S&OP process, such as turnover development, on-time delivery, customer order backlogs, customer lead times, customer service indicators, inventory value, unplanned overtime, and lay-off costs. There are also two S&OP specific performance indicator – forecast accuracy and forecast bias – which both measure how much the forecast and reality differ and is it systematic. (Parravicini 2015, 186-187; Logistiikan maailma 2021)

4.5 Benefits of the process

Sales and operations planning process purpose is to figure out the demand (sales) and make sure that the company's operations can provide the means to fulfill the demand. It links the company's strategic plan to its operations and even further more to its detailed processes like order entry, production planning and purchasing – activities and functions that are needed to run the business on a day-to-day basis. Related to this, as the most critical output S&OP provides a sales and operations plan – also referred to as a business plan – to serve as a direction guide for all functions within a company. In case company wants to make major changes in their business or within their organization, sales and operations planning process will also work as an important management system to ensure that the decisions are implemented into the day-to-day operations as desired by the top-management. (Sheldon 2006, 4; Feigin 2011, 70; Parravicini 2015, 168)

One of the key benefits of S&OP process is to give visibility to the gaps between the sales forecast and the company's strategic target in the annual operations plan. Without these gaps being visible, opportunities cannot be identified and alternative and corrective actions planned to fill those gaps. The sales and operations plan also provides a basis for the daily, tough-minded trade-off decisions to fill those gaps – in example if additional production for some item is needed, it can not be done without corresponding reduction for some other item or it would violate the agreed-on operations plan. (Jacobs, Berry, Whybark & Vollmann 2011, 93; Parravicini 2015, 178)

Another benefit of sales and operations planning is to be able to run the business with one set of numbers. The S&OP process intention is to produce complete and integrated plans, budgets and goals that are used by managers as a basis for making decisions and evaluating performance. Running a separate performance measurement system or a budget will result in wasted resources, as well as mixed decisions making trade-offs – managers will need to make a choice between sales and operations plan and the separate budgeting or performance measurement system. (Jacobs, Berry, Whybark & Vollmann 2011, 107)

Sales and operations planning is top management's handle on the business, enables them to view the business holistically and gives them visibility into the future. All the benefits of an effective S&OP process can be seen in the company's key performance indicators – resulting in better customer service, lower excess inventory, shorter customer lead times, more stable production rates, higher profit margins and overall smoother workflows within company's operations. (Feigin 2011, 70; Jacobs, Berry, Whybark & Vollmann 2011, 93; Jacobs, Chase & Lummus 2011, 566; Parravicini 2015, 168, 178; Logistiikan maailma 2021)

5 EXECUTION OF RESEARCH

The purpose of this thesis is to provide a development proposal for the target company's sales and operations planning process. The objective of this research is to recognize the current state and key improvement areas of the process. This information will then be used as a basis in creating the development plan and proposal for the process. This research is conducted to find out the answers for the two key research questions: How is the sales and operations planning handled now and how can the sales and operations planning process be improved.

5.1 Research plan

Literature analysis from the business nature of EMS industry and the sales and operations planning process are a starting point of this research. Understanding the principals of S&OP and what kind of environment in general is EMS industry are vital for providing the best possible development proposals for the target company. The research methods that were chosen to be used for data collection were: questionnaire, interviews, observation and performance monitoring. It was determined that these methods together provide the best possible insight to the company's sales and operations planning process. As an outcome of analyzing the data collected with these methods, the current state of the process and key improvement areas were identified. The process of the research plan is shown in figure 9.

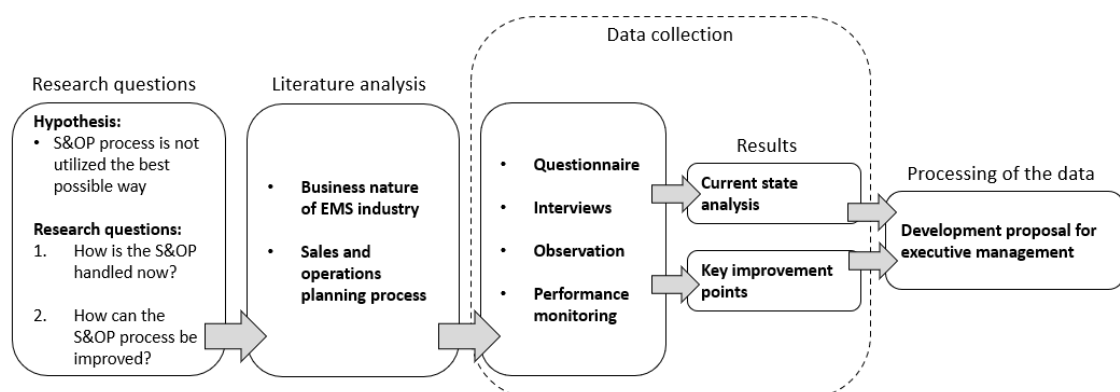


Figure 9. The process of the research plan.

5.2 Questionnaire

The most common data collection method is the questionnaire. Questionnaires can be used for both obtaining subjective information about participants and to document objective, measurable impact results. Questionnaires usually consists of any of all of these types of questions; Open ended questions – allow unlimited answers, checklists – participant is asked to check from a list of items, two-way questions – limit answer to a pair of alternative responses, multiple-choice questions – limit answer to several possible answers and ranking scales – participant has to rank a list of items. (Phillips & Stawarski 2008: 1-2)

In the questionnaire conducted for this research, the questions were split to two different categories: multiple-choice questions and ranking scales. For the questionnaire answers to be comparable, these two question categories provided to best possible outcome for analysis. Open ended questions would have given the answerer too much room for variance, and most likely caused the answer to be very different from each other. Limiting the answers with a two-way questions on the other hand would have given a very narrow view on sales and operations planning process itself. The questionnaire purpose was to obtain subjective information, which could then be used for both individual analysis, but also for a collective analysis when all the answers are put together.

The questionnaire was sent to persons who operate in different roles and parts of the organization and either in management or top management role, and whom are a part of the current sales and operations planning process. The total number of persons the questionnaire was sent to was eight, and all of them answered the questionnaire. The questionnaire was conducted with web-based Microsoft Forms -software.

Before sending the questionnaire, the background and purpose of the research was clearly explained to attending individuals. The purpose of the questionnaire was two-parted: to get picture of the current state of S&OP process, and find out the things that are considered to need improvement. Each individuals answers created to theme for which the individuals interview will focus on.

The questionnaire included evaluation of the current quality of the S&OP process, evaluation of how well key functions within the sales and operations planning process are currently executed, and how important these functions are seen regarding the S&OP process. All these were evaluated with grades from 1 to 7, 7 being the most positive

grade that can be given. Then the questionnaire involved questions for which of the functions presented would need the most improvement, and what is the current S&OP cycle in use. For the improvement question, the answerer also had an option to freely write anything that he or she felt needed improvement the most. Finally the last three questions were regarding if the sales and operations planning can be improved with internal actions, if S&OP plays a key role in company's customer service performance in the future and whether the S&OP plays a key role in company's business performance and success in the future. The last three questions were graded from 1 to 7 again, 7 being the most positive grade that can be given. The content of the questionnaire can be seen from appendix 1.

5.3 Interviews

Interviews can often secure data that is not available in performance records or data that is difficult to obtain through written responses. Interviews may uncover more data through participants' reactions than surveys and questionnaires. Interviews fall into two categories: structured and unstructured. A structured interview is almost like a questionnaire – specific questions are asked with a little room for variance in the responses. An unstructured interview allows participants to answer with more variance, but also allows the interviewer to probe for additional information. Usually unstructured interviews use a few general types of questions that can lead to more detailed information. (Phillips & Stawarski 2008: 23-24)

Interviews were scheduled so that the questionnaire results had been collected and preliminary analysis created. Interviews were unstructured, conducted partly based on the results of the questionnaire. All the interviews started with and included a couple of before-thought questions based on the individual's questionnaire answers. These questions were conducted to lead the way to the deeper, more detailed information. The purpose of the interviews was to get a better picture of the details behind the questions in the questionnaire, and to get more information from the sales and operations planning process than what the questionnaire allowed for. Each individual was interviewed separately, so everyone could bring out their own view of the process and the responses would not be influenced by other people. All of the eight persons that had answered the questionnaire were also interviewed, and each interview lasted 30 to 60 minutes. The questions of each interview were at some level tailored based on the interviewees

answers in the questionnaire, and the role and responsibilities the interviewee has in the company. This was done to give as wide picture of the current process and responsibilities as possible, and to make deeper knowledge of certain aspects of the process available. In example, it could be expected that a sales manager has better knowledge of the parts of the process where sales managers role is needed and a part of. In addition, the interviewees were also asked to bring up more wider view of different parts of the S&OP process, not just the part they were directly involved in. The structured questions of the interview were planned to take the discussion in to deeper level, allowing the interviewer to access information through unstructured questions and discussion. The structured questions presented in the interviews were more of a general type, which gave the interviewees more room for variance in their responses. Examples of structured questions that were asked:

- Based on your answers, function 1, 2 and 3 need the most improvement. Why is that and what do you see could be done to improve these functions? How can the poor functioning of these be seen in the S&OP process?
- Based on your answers, functions 4, 5 and 6 are working well. Could you elaborate? How can this been seen in the S&OP process?
- Any other aspects of the process that would need improvement in your opinion?
- What are the roles involved in the S&OP process?
- What acvities are involved in the S&OP process?
- What are the biggest individual challenges in the S&OP process, and how can these be tackled?
- How can the S&OP process be improved internally and what are the greatest challenges / bottlenecks for the improvement?

Part of the interview process was observing the interviewee – following if there was any changes in the behavior when being asked or answering to the questions. The interviews

were originally planned to be kept face-to-face, but the COVID-19 pandemic stopped that from happening – the target company’s policy throughout the pandemic has been to favor remote work and avoid unnecessary face-to-face engagement. Because of this, interviews were conducted through Microsoft Teams -software.

5.4 Performance monitoring

Different data for performance monitoring is available in every company. Performance monitoring is purely based on performance data – such as output, quality, costs and time. In most companies, there are some record-keeping systems and that is where it is the easiest to find the data for monitoring. (Phillips & Stawarski 2008: 35-36)

One way to find possible improvement targets in the company’s S&OP process was to take a look at the company’s performance measures. The company has many measures built in their ERP, such as turnover, order book, inventory value by raw materials, semi-finished and ready products, and customer order backlogs. Some reports and measures are built outside of the ERP but using data available in the ERP, such as on-time delivery. Monitoring performance measures enables to see if there has been any changes regarding any measure within some months, a year, or a couple of years. If these changes are pointing to a negative direction, it can be viewed as an indication of something that can be improved in the sales and operations planning process.

5.5 Current state analysis

Current state analysis describes the state of the current sales and operations planning process. The questionnaire, interviews, and performance monitoring provide the basis for the analysis. By comparing the answers and feedback received in the questionnaire and interviews to the development of company’s performance indicators, a realistic view for the current state of S&OP process can be reached.

6 RESEARCH RESULTS AND CURRENT STATE ANALYSIS

There was a total of six different information gathered and used in this research. All engagements with the company participants were encouraging, and more and more thoughts and observations came up in different phases of the research. All information used in this research together with sources, purpose and target are presented in table 1.

Information	Source	Purpose or target
Literature analysis	Books, articles	Author of the research – understanding S&OP, and EMS business
Questionnaire	Web-based questionnaire with Microsoft Forms -software	Author of the research – current state analysis and key improvement areas
Analysis from questionnaire	Author of the research	Participants of the interviews – using questionnaire answers as a basis for individual interviews
Interviews	Remote interviews with Microsoft Teams -software	Author of the research - current state analysis and key improvement areas
Summary of the questionnaire and interviews	Author of the research	Participants of the interviews, executive management, and author of the research – current state analysis and key improvement areas
Performance data	Company's ERP	Author of the research – current state analysis & key improvement areas
Company introduction	Company internet page	Introduction of the target company

Table 1. Research sources.

6.1 Research results

Research results were two-parted; summary and analysis of the questionnaire and interviews, and performance monitoring analysis of target company's key measures describing the performance of sales and operations planning. These research methods

and results were seen to well represent the current state and key improvement areas of the company's S&OP process.

6.1.1 Questionnaire and interview results

The questionnaire was sent to a total of 8 persons, all of which gave their responses to the questionnaire. Based on the questionnaire, an analysis was done for each individuals answers, and this analysis worked as a basis for the individual interviews. The main focus in the interviews were in the functions that were assessed to have the most to improve, and also in the functions that were assessed be in great shape. The purpose was to find out more detailed, what could be improved, and on the other hand, what is working great already and why.

Four functions that were assessed to have the most to improve were Sales forecasting & demand planning, Supply planning, Balancing demand and supply planning, and Measuring the performance of S&OP. Out of these functions, the first three were equally assessed to need improvement the most:

- Sales forecasting and demand planning improvement areas were mainly two-parted: the visibility from the customers for to future was seen to be too short, and the communication internally between company's sales and operations could be improved. The short visibility makes it harder for the operations, and the whole company, to see the future demand and make plans to meet the demand – in example adjusting resources, acquiring components, making investments, or predicting cashflow. Internal communication regarding sales orders and the progress of these orders was seen to be very frequent and active, and the need of improvement was more regarding the communication to be more organized.
- Supply planning improvement areas were regarding the material flows. Especially now that the Covid-19 pandemic, the global chip shortages and disruptions in the global supply chains have caused more delays, uncertainty and drastically longer lead times for materials, causing planning and confirming product deliveries for company's customers to become greatly harder. This has also led to difficulties in effectively planning manufacturing capacity, as well as planning the company's future business in general. It was also seen that the

internal communication related to supply planning could also be improved to be more systematic and organized.

- The improvement areas of balancing demand and supply planning were focused on the same key improvement areas as mentioned above.

The functions that were assessed to be working the most effective currently were Handling of necessary changes in operations to meet the plans, Effective decision-making and Use of data available in the ERP:

- Handling of necessary changes in operations to meet the plans was seen as a key strength of the company. Flexibility, reacting and making quick changes in operations to meet the sudden and unexpected customer demand was seen to work effectively throughout the organization. Actions like quick adjusting of capacity – such as overtime and extra shifts, rapid change of manufacturing plans and sourcing components from different sources to sudden demand supported by processes created for this purpose was highlighted to be a key competence of the organization. On the other hand, it was criticized that the long-term planning of handling the necessary changes in operations to meet the plans needs improvement. This issue was seen to be caused by the weak visibility for customer demands for the longer future, the global chip shortage and disruptions in the global supply chains, and in some level unclear view of what are the objectives and requirements from the operations in the longer term.
- Effective decision-making was described to be two-parted; very good and on the other hand in need of improvement. Decision-making is effective in the lower levels of the organization; the decision-making behind the flexibility to meet unexpected customer demand and handling of necessary changes to meet the plans in the operations was seen as a great example of effective decision-making. It was seen that the decision-making on the top management level of the organization could be improved to be faster paced, and that the communication regarding the decisions could be improved to be better carried out throughout the organization. The decision-making, roles and responsibilities was also seen to be somewhat unstructured and clear guidance for decision-making process and responsibility-matrix was partly missing. The company has had recent

organizational changes both in higher and lower-level of the organization, and these were also seen to have at least a temporary weakening impact for the decision-making within the company.

- Use of data available in the ERP was seen widely used to support the company's operating. The data used in the ERP is working as a core basis for the company's key functions; such as sales forecasting and order handling, material and capacity planning, inventory handling, tracking production throughput, cost tracking, financial management and governance. The data from the ERP is also used for measuring purposes; all the data needed for key performance indicators of the company is available in the ERP, and therefore the KPI's can be monitored in real time. Again a need for improvement for visibility and long-term planning was brought up; the weak long-term visibility for customer demand does not allow the ERP data to be used for long-term business forecasting and planning.

The general importance of sales and operations planning playing a key role in company's customer-service and business performance and success was seen very high. It was also seen that the sales and operations planning in the target company would need improvement, and that it could be improved with internal actions. But it was also stated that after reaching a certain level, external resources for improving S&OP might be needed.

In table 2 and figure 10 is presented the importance of each function based on the questionnaire answers. The grading was from 1 to 7, 1 meaning that the function is not seen very important in the S&OP process, and 7 meaning that it is seen very important. In table 2, the evaluation of each of the eight respondents for each function can be seen. Below in the table is presented the average and median of the evaluations for each function. In figure 10, the same average values are presented with a blue line and median values with a yellow dot line.

	Sales forecasting & demand planning	Supply planning (capacity, material and resource planning)	Balancing demand & supply planning	Product family grouping & prioritizing	Communication between functions	Handling of necessary changes in operations to meet the plans	Effective decision-making	Use of data available in the ERP	Measuring the performance of S&OP
Respondent 1	5	6	6	6	7	7	7	7	4
Respondent 2	7	7	7	7	7	7	7	6	5
Respondent 3	7	6	6	4	5	5	5	7	6
Respondent 4	7	7	7	6	6	7	7	7	7
Respondent 5	6	6	7	5	7	6	7	5	6
Respondent 6	7	7	7	5	7	7	7	7	7
Respondent 7	7	6	5	7	6	5	5	7	5
Respondent 8	7	7	6	6	7	6	6	6	6
Average	6,6	6,5	6,4	5,8	6,5	6,3	6,4	6,5	5,8
Median	7	6,5	6,5	6	7	6,5	7	7	6

Table 2. Importance of each function in target company's S&OP tabulated.

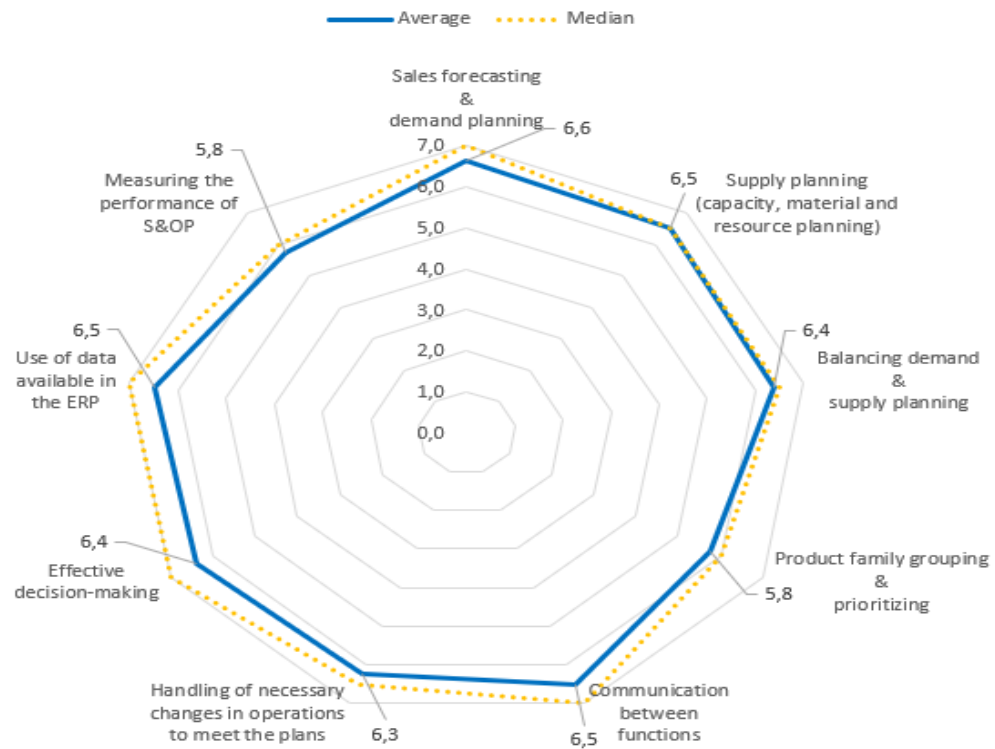


Figure 10. Importance of each function in target company's S&OP as a figure.

In general, the transparency between customer demand and Tepcomp operations is seen as a critical factor in fulfilling customer requirements and effective operating, especially with the supply chain challenges of today. Internally, it is essential that the customer demand is well-known and up-to-date, and shared to the operations team. Externally, Tepcomp operational situation, plan and changes should be as visible, and as actively communicated to the customers as possible to keep customers satisfied and up-to-date. Flexible operating in challenging circumstances requires transparency to go both ways.

6.1.2 Performance monitoring results

In this research, the performance monitoring analysis was focused on the development of target company's key performance indicators such as turnover, profit, total order book value, inventory value and on-time delivery. These key performance indicators were chosen because they effectively describe and have great effect on sales and operations

planning process and performance. The review period was from 2020 to the end of 2021, as the time period of two recent years was seen to describe the latest state and performance of the S&OP process the best. There has also been major changes in company's customer base in the end of 2019, which had relatively big impact on the key performance indicators, and therefore the KPI numbers from 2019 would have not been comparable for 2020 and 2021 KPI numbers.

- Company's turnover in 2020 was 11,2 million euros. The revenue for 2021 has not been published at the time of writing of this thesis, but revenue is expected to have increased by a maximum of 10 percent from 2020.
- Company's profit in 2020 was -112 000 euros. The profit for 2021 has not been published at the time of writing of this thesis, but the profit is expected to be lower than it was in 2020.
- Company's total order book value has significantly grew from the end of 2020 till the end 2021. In the end of 2021, the company's order book value is greater than it has ever been in the history of the company.
- From the end of 2020 until the end of 2021, the target company's inventory value has been significantly increasing throughout the year. Vast majority of the inventory value consists from raw materials.
- Company's on-time delivery was strong throughout 2020, but has been lower in 2021.

6.2 Current state analysis

Sales and operations planning process in the target company seems to be unstructured, and the cycles and ways of operating vary based on the function or organization. Demand planning for near future – next couple of weeks or months – is usually done on a weekly basis. Demand planning for longer future, three or more months ahead, is done once a month or max quarterly. The demand planning for the near future is done on a very accurate level – the products and quantities are mostly known. On the other hand, the demand planning for longer future has been mostly done on a very general level.

Usually demand has been estimated on a customer level, but the products and quantities have not been specified. Company has taken steps to improve the longer-term visibility by requesting longer visibility from customers, and this process is ongoing. Some KPI's also indicate progress has already happened in gaining visibility from customer – order book value has grown significantly within the year 2021. At the same time company's turnover has grown around ten percent, which indicates growth in demand, but even stronger growth in visibility for longer future. The sales and operations planning related financial planning is done in same cycle as the demand planning – near future planning is done on a weekly basis, longer future planning is done once a month or max quarterly.

On the supply planning side, the short-term planning is done on a weekly, sometimes daily basis. The longer-term supply planning for the next three or more months has been done on a monthly basis, but the planning and decision-making is difficult, because demand planning is not done on a product level and the visibility for longer future demand is often not available or properly communicated.

In all phases of the current sales and operations planning process, the process of sharing information with other functions seems not to be systematic and information is shared more individually than collectively. The roles and responsibilities within the demand and supply planning teams seem to be quite clear, but roles and responsibilities directly towards the S&OP process seems to be unclear. Also documentation of the sales and operations planning process, starting from process description, seems to be deficient. Partly because of these, pre-SOP or executive SOP meetings are not taking place regularly, which is also one of the reasons why the information sharing and decision-making is done more individually than collectively.

Company has a lot of key performance indicators in place, which aren't directly S&OP measures, but well indicate the effectiveness of sales and operations planning process. These indicators are updated and reported every month, and also the development of these KPI's is being monitored. The data handling and gathering seems to be pretty well managed, and with minor adjustments, should support the S&OP process.

The development of some of the company's key performance indicators indicate, that the current sales and operations planning process is not working in an optimal way. Below some KPI's which indicate room for improvement:

- Target company's revenue growth in 2021 was around ten percent, while the inventory value increased more significantly, and most of the inventory value

came from materials. Although it could be business decision to ensure materials and grow the inventory value, the significant growth in inventory without close to similar growth in revenue indicates that materials have been bought into stock with either some materials missing to enable producing the products or a decrease in actual customer demand versus customer forecasts. In either cases, optimal situation would have been to postpone the material arrivals for when products need or can actually be delivered and to shorten the inventory turnaround time for as short as possible.

- On-time delivery has decreased in year 2021, which is an indication that the global interruptions in the supply chains and in component availability has caused unexpected issues in the target company's sales and operations planning, and the target company has not been able to handle the issues in an optimal way.
- Company's profit has decreased in 2021, which is an indication that target company has not been able to transfer costs – either planned or unplanned – to their sales prices. It is likely that the global pandemic, chip shortage and interruptions in the supply chain have caused relatively great amount of unplanned costs within the year.

Global pandemic Covid-19, global chip shortage and interruptions in the global supply chain have likely caused overall issues in the business of the target company. These are likely part of the reason why some KPI's have been pointing in a negative direction in the past year, but the development of the KPI's are also a clear indicator that at least when put to higher pressure, the current sales and operations planning process is not working ideally and there is room for improvement.

6.3 Reliability of the research

The research methods used for the research – questionnaire, interview, observation and performance monitoring – can be seen as reliable methods for providing solid basis for the current state analysis and recognizing improvement areas. The questionnaire and interview were held individually, and the respondents were informed that their individual

answer will not be shared to any others except for the conductor of the research. This created a solid base for respondents to give truthful and reliable information. Observation was not conducted because of the global pandemic situation at the time of the interviews, and therefore observation was only done partly through Microsoft Teams -software. This is also why the observation was conducted inadequately, and therefore observation results were unreliable and were not eventually included in the research. Performance monitoring can be seen the most reliable of the used research methods, as the performance measures or the data used for the measures were taken directly from the company's ERP system.

For the analysis purposes, the individual questionnaire and interview answers gave a subjective view from the perspective of each respondent. The reliability of an individual answer might be misleading, as it only describes the sales and operations planning from a certain perspective – individual person perspective from a single function or part of the S&OP process. In this analysis these individual answers were collected together and analysis done based on all the answers given. Because the analysis was done collectively based on different perspectives from different people from different parts of the S&OP process and the company organization, the data and results of the analysis can be held reliable to describe the current state and improvement areas of the process. The current state analysis and recognizing the improvement areas solely based on the performance monitoring results could lead to misinformation and unreliable data and outcome, because there are many other business processes and external factors in addition to S&OP that also effect on the measure and key performance indicator values. But it is also clear that S&OP has a significant effect on the measures and KPI's especially in the manufacturing industry, and this together with the information gathered from the other research methods used in this research can be seen to provide a very reliable analysis basis and results.

7 DEVELOPMENT PROPOSAL

In EMS business, and especially in target company's case, sales and operations planning is a complicated process. Yearly sales split to very many products and customers, and therefore having a large quantity of different components and materials flows to handle, and many different, complicated manufacturing processes to be used in a quick ratio requires active, flexible and effective sales and operations planning.

To better enable understanding of the whole process and to give better view on the development proposal and its effects in the sales and operations planning process, instead of focusing just for the key improvement areas, the development proposal consist of a whole, high level process description. In addition, the key roles and responsibilities needed in the process, key elements and benefits of implementing and successfully using the process, together with implementation requirements will be presented.

7.1 New process description

The focus in the sales and operations planning needs to be in handling the key customers and products in the longer future, so the focus needs to be turned from looking just the next few days, weeks or next month for planning also the next three, six, 12 or 24 months. It is critical in target company's case to keep the focus in the main customers and products, and try to avoid detail-handling the large amount of customers and products the company has. Focusing too much on single orders makes it extremely difficult to see and handle the bigger picture effectively. A clear, structured guidance for the roles, responsibilities and decision-making matrix in S&OP process needs to in place. There are already clear teams handling certain aspects of the S&OP process, but more structured, organized way to enable the communication between them needs to be established. It is critical that all roles, responsibilities, and process description should be documented so that these can be double-checked by anyone at any point.

The complicated nature and rapidly changing customer demand requires active and frequent cooperation and communication within the sales and operations planning. Therefore, the proposal is to create a two-parted sales and operations planning process; a five-step S&OP process with a monthly cycle, including a senior management S&OP cycle with a twice a month cycle, capable of adapting to a once a week cycle if needed.

Steps one to four are part of the senior management cycle, and this process cycle is presented in figure 11. The fifth step, involving the company executives, will only take place monthly. The monthly process cycle including company executive meeting is presented in figure 12.



Figure 11. The four step senior management S&OP process cycle.

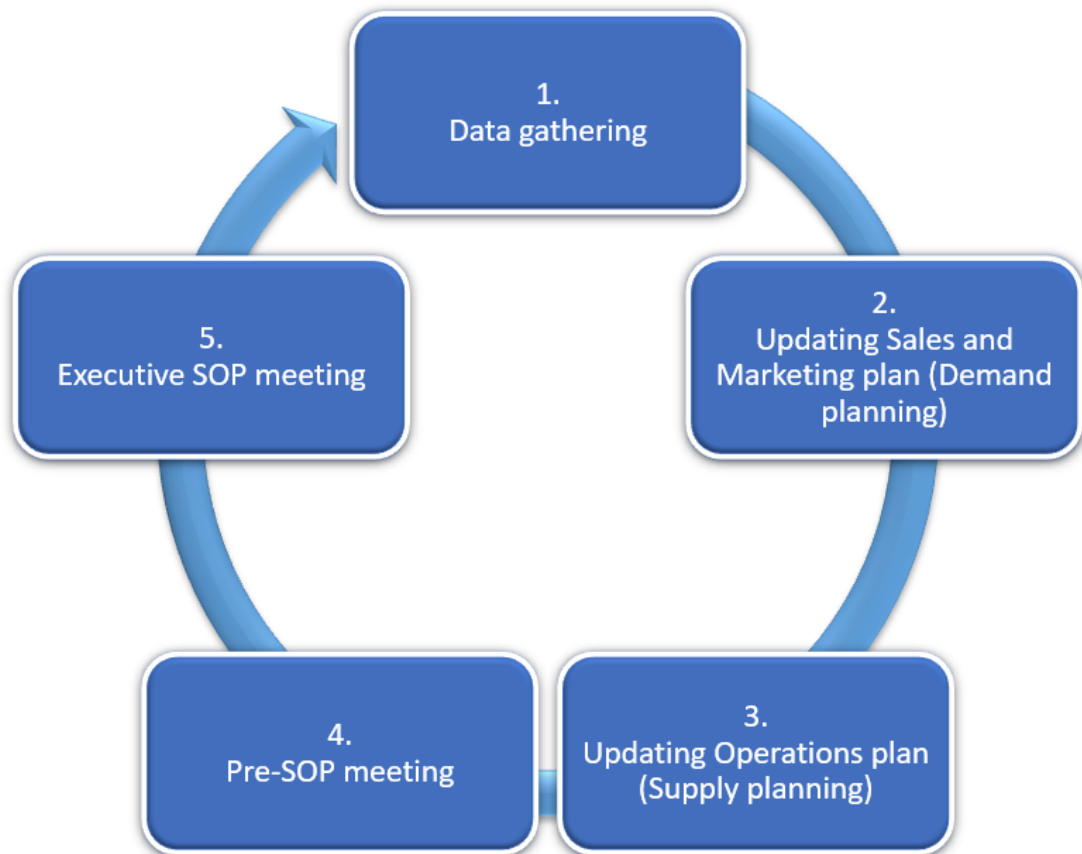


Figure 12. The five step monthly S&OP process cycle.

The five steps of the two parted sales and operations planning process are:

1. Data gathering

The cycle always starts with data gathering. For the senior management cycle, the data is gathered after middle of the month – 15th of every month – has passed, to view the situation for the first half of the month. At the end of every month, the data is pulled for the past month, as the executive SOP meeting will only review monthly progress and changes.

After every cycle, actual sales, production, inventories, and other relevant data is gathered partly or wholly from ERP, and shared to appropriate people. In case some relevant data is not available in the ERP, then representatives from different function share relevant information with each other. The appropriate people are the responsible persons from demand planning team, supply planning team and finance team. This data is used for comparing actual versus plans to see if everything is going

according to what has been planned. This information also works as a basis for marketing and sales in developing sales analysis reports, and changes to sales forecasts.

2. Updating Sales and Marketing plan (Demand planning)

The information received in step 1 is reviewed by demand planning team. This information is analyzed, and sales analysis reports – comparison between forecasted and actual – are developed. As an outcome of this step, the demand planning team agrees on an updated sales and marketing plan which is then shared to appropriate people. The sales forecast should be unconstrained, and therefore should not contain foreseen risks or potential shortages, such as component availability, lead times or manufacturing issues. The sales forecast should consist of short, mid and long-term forecasts. Short-term forecast should be one to three months, mid-term from four to 12 months and long-term is from 13 to 24 months out. The short-term forecast needs to be the most detailed. In target company's case, because of the large variety of customers, products and customer specific materials, it is extremely important for the forecast to be as detailed as possible for as far to the future as possible. Given the circumstances and challenges in the global supply chain, a 12 month rolling horizon is recommended as a minimum for the key customers and product family groups chosen to be reviewed in sales and operations planning process.

3. Updating Operations plan (Supply planning)

In this step the capacity and resource planning takes place. Operative decisions – production, capacity, inventory and procurement – are made by the supply planning team based on the updated sales forecast. The supply planning team bring their own knowledge to the table – in example manufacturing capacity, lead times – and create or update the operations plan based on that. In case shortages are noted, prioritization policies need to be developed. If major risks are notified, contingency plans need to be developed. In case changes in operations plan are needed, if for example demand exceeds supply by a too large margin, these changes often need to be authorized by the top management. These issues are carried to the next step; pre-SOP meeting.

4. Pre-SOP meeting

Representatives from different functions – senior management – make necessary decisions regarding the balance of demand and supply. Issues and updated plans from earlier steps will be reviewed in this meeting, and problems where differences in recommendations exists will be solved. Finance will present the cashflow plan, and finance has a veto power to request changes to enable better cashflow planning. As an outcome of this meeting, a consensus forecast plan, or changes to previous plan, are agreed. Agenda and issues that cannot be solved in this meeting will be prepared to be presented in the executive SOP meeting.

5. Executive SOP meeting

The final step is the executive SOP meeting. This meeting involves the company's top management – senior executives. The purpose of this meeting is to discuss and finalize all relevant plans, review customer service and business performance, authorize spending for changes in the operations plan, evaluate the collective impact of S&OP plans to overall business plan and resolve the issues which couldn't be solved in the pre-SOP meeting. It is also the executive committee's responsibility to overlook the S&OP process critically at the end of each cycle to identify improvements for the following S&OP cycles.

All the assumptions behind every plan in the S&OP process should be documented for future reference. This will support the learning and accountability, and help the comparison of the assumptions to the actual results. It is also often more reasonable to question the assumptions of a plan, rather than question the numbers in the plan. This will open more discussions around the plan, and help reaching aligned assumptions in the sales and operations plan.

Target company's current organization structure has many members of the senior management also as executive management members, so it could be considered that pre-SOP meeting and executive SOP meeting would be one, same step. It could also be considered, that a certain group of people are named as the senior management of sales

and operations planning process, if that is seen clear the roles and responsibilities and to provide better results.

7.2 Key elements & implementation requirements

In order for the development proposal of sales and operations planning to be successfully implemented and used, there are certain key elements that need to be defined and taken into use. Some of these elements need to be defined before or during the implementation of the development proposal, to ensure that the process runs smoothly and effectively. Many of element are also essential to get the best possible outcome from S&OP process, and to keep the process working and improving in the future. The key elements for effective S&OP process are:

- Roles, responsibilities, and decision-making matrix needs to be established. Roles and responsibilities of the S&OP process needed in the development proposal are presented in chapter 7.3. Decision-making matrix is created to clearly define the decisions each representative or team can make without needing the approval of senior or executive management. It is also important to bring forward the type of issues and decisions that need the be authorized by the senior or executive management. This matrix should be documented and made available for the members of the sales and operations planning process. All these should be clarified in implementation phase of the development proposal, and then modified if needed.
- Product family grouping and prioritization is essential for the focus to stay in the bigger picture. In target company's case, the customer and product base is very wide, which increases the importance of product family grouping. Despite the wide variety of customers and products, around ten of the top customers represent vast majority of company's business. Therefore it could be considered to focus on reviewing and handling these key customers and their key products. Some key customers or products can also be added from outside of the top 10 list, if the company sees a different kind of importance in them. But it is crucial to keep this list limited, so that the focus of S&OP process will be more in the bigger picture, and not detail-handling every single customer or order. A guidance for handling the customers and products left with less attention in the S&OP process

must be established. Product family groups and prioritization rules should be agreed in implementation phase of the development proposal, and then modified if needed.

- Time fences must be agreed. The feasibility of changes often vary by product family, and are often time dependent. Therefore, time fences should be introduced to determine the level of changes to plan that can be accepted for each product family. A frozen period, where changes are not possible, and then different time periods where certain changes are possible, and a time period where practically every option is possible, should be clarified. A variance for each time period could also be clarified, in example the three to six month forecast demand can vary by 15%. Time fences should be agreed in implementation phase of the development proposal, and then modified if needed.
- Minimum of 12 month rolling sales forecast is needed. The large variety of different products with different materials, manufacturing and capacity requirements in the company's business, is it extremely important to gain visibility for the future for the key customers and products. With the high mix / low volume manufacturing, the importance of acquiring the right quantity of right components at the right time, knowing what products will be produced and when, and preparing and planning the right amount of capacity for the right time is very high. Therefore, it is critical that the forecast is very detailed and divided to the product level. Without a very detailed product level forecast in the high mix / low volume manufacturing environment, it is very challenging for operations and finance to create the plans required from them. Having the visibility for customer demand, together with active communication with the customer plays a key role in achieving the goals set for S&OP process and company's entire business, and these are something that should be considered as high priority.
- High level of commitment and overall active participating from top management is highly important. Top management will be responsible for setting up the demand and supply planning teams. Top managements obligation is also to establish a framework for the sales and operations planning development, and follow up once the development proposal is established. Following the

performance of sales and operations planning process and identifying improvements are also top management's responsibilities.

- Performance of S&OP process must be measured and should be audited and continuously improved. Many of the usual company KPI's work well as S&OP indicators. Indicators that should be considered for measuring sales and operations planning process are for example forecast accuracy, inventory value, on time delivery, customer order backlogs, and customer service indicators. Some of these measures are affected by other factors of the business, but still represent the effectiveness of S&OP process well. Appropriate measures should be agreed in the implementation phase of the development proposal.

This development proposal provides guidance for the target company to improve the higher level functioning of the S&OP process. This improvement proposal must be aligned with the practical operating of the company, including all support processes, usage of their ERP and all activities and functions that are needed to run the business on a daily basis. This aligning is a critical factor in successful implementation of the improvements. The implementation of the proposal can be done with target company's internal resources, and at this stage external resources are not necessarily needed.

7.3 Key roles and responsibilities

In order for the coordination of functional activities, the cross-functional communication, and entire sales and operations planning process to be as clear and as effective as possible, every manager and director must know exactly what is expected of them and their team / colleagues.

Executive sponsor.

This role needs to be filled by either the chief executive officer of the company or a senior executive with close relationship with the CEO. Ensuring necessary resources, clearing major obstacles and keeping top management's focus on the S&OP process are executive sponsor's responsibilities.

S&OP process owner.

This person is responsible from leading the implementation effort and providing leadership for the sales and operations planning process. Person suitable for this role is well-organized and has good people skills.

Demand planning team.

This team could include roles such as sales manager, salespersons, account managers, forecast analyst, and S&OP process owner. Depending on company organization, also product manager and new product coordinator can be involved. This team is responsible for developing sales analysis reports, providing and updating the sales forecast and sales and marketing plan and sharing the forecast and plan to appropriate people.

Supply planning team.

This team could include roles such as master scheduler, plant managers, purchasing manager, and S&OP process owner. Depending on company organization, also materials manager, production control manager, and new products coordinator can be involved. This team is responsible for providing and updating operations plan based on sales forecast and the knowledge on resources – capacity, materials, machines – that the team has. This team is also responsible for recognizing risks or shortages in the sales forecast, and preparing contingency plans and change proposal resource-wise to balance the supply with demand. All these issues should be prepared to be presented for the pre-SOP team.

Pre-SOP team.

This team could include roles such as master scheduler, forecast analyst, sales manager, plant managers, purchasing manager, controller, and S&OP process owner. Depending on company organization, also product manager, materials manager, customer service manager, and new product coordinator can be involved.

Executive SOP team.

This teams should include the CEO, directors of sales, marketing, operations, logistics, finance, and the S&OP process owner. Also directors of human resources and product development can be involved. This team is responsible for finalizing all relevant plans, reviewing customer service and business performance, authorizing spending for changes in the operations plan, resolving issues that the pre-SOP team could not resolve, and evaluating the collective impact of S&OP plans to overall business plan. Executive SOP team is also responsible for supporting and identifying improvements for the S&OP process.

Some supportive functions and roles are also needed. The smooth flow of S&OP process is much dependent on information technology. Therefore it must be ensured that IT tools are supporting data gathering, forecasting and planning, and that there is a person or a team ready to support in IT related issues and improvement requests. Budgeting process should be aligned in an integrated fashion to the sales and operations planning process, so that the same set of numbers can be used in both processes – this will also make decision-making easier, when decisions can be based on the set of numbers and key performance indicators instead of having to make trade-offs between these two.

7.4 Benefits of implementing the development proposal

Implementing the development proposal will give the company's top management a better visibility for the future, enabling them to better recognize gaps and opportunities between the sales forecast and annual operations plan. The better visibility also gives overall better opportunity to plan and evaluate the company business in the longer future, in example see the opportunities or risks investments in resources will bring. With a well-documented process, roles and responsibilities the improved sales and operations planning process will work as direction guide for all the functions within the company, providing top management a management system to ensure that the desired decisions are implemented in to the day-to-day operations.

The results of implementing the development proposal can also be seen indirectly in all the key performance indicators of the company. With sales and operations planning process providing a structured, active cross-functional communication channel, the interruptions and rising issues can be handled with a short time table, resulting in more precise production planning and sourcing of materials, more proactive share of information both internally and externally, and better view and handle on the unexpected costs. These will eventually result in lower inventory levels, more stable production rates, shorter customer lead times, higher profit margins, and better customer service.

7.5 Implementation risks

There are some risks that might cause issues or stop the implementation of the improvement proposal, and result in wasted resources. The greatest risk is lack of commitment and active participating from the top management. In order to get these

changes implemented throughout the organization into the day-to-day operations, top management needs to actively drive and support the implementation.

The prerequisites presented in chapter 4.3.2 – understanding of the S&OP process, assigned roles and responsibilities, time commitment of the participants, product family grouping, planning horizon, time fences, and data and IT tools – must be in place in order for the process and improvement proposal to provide the desired effect and the implementation to succeed. These should all be documented to provide guidance and avoid conflict.

Sales and operations planning and budgeting process, together with the performance indicators, should be aligned in an integrated way. If these are two separate processes, it is likely that these processes will cause mixed trade-off decisions in daily operating. This will result in inconsistent actions and inefficiency at some level, and possibly cause issues in implementing the improvement proposal.

8 CONCLUSION

The global market of the electronic market is expected to strongly grow in the years to come, and this together with a growing trend towards outsourcing will provide a solid expanding opportunities for electronic manufacturers. On the other hand, global pandemic Covid-19, global chip shortage and interruptions in the global supply chain have caused several issues in the whole electronic manufacturing industry, and the target company of this thesis has not been an exception to other companies in the industry. These global challenges have put the target company's business processes into a test, sales and operations planning process possibly being tested the hardest. These challenges are likely part of the reason why some KPI's of the target company have been pointing in a negative direction in the past year, but the development of the KPI's are also a clear indicator that at least when put to higher pressure, the current sales and operations planning process is not working ideally and there is room for improvement. These global challenges also offer great opportunities for European electronic manufacturing companies – companies are trying to solve the short term interruptions by acquiring services or products from manufacturers closer to them, and more companies are even looking for opportunities to move their product manufacturing closer to their own facilities to avoid similar situation in the future.

The sales and operations planning is a cross functional process, occurring at different levels within the company. S&OP is used by the top management to balance demand and supply in order to operate profitably. Sales and operations planning purpose is to link the company's strategic plans with its operations, and provide key communication links for the top management to coordinate and integrate all the financial, marketing, sales, operational planning. The sales and operations planning process usually consist from a five-step, monthly or more often conducted planning cycle – data gathering, demand planning, supply planning, pre-SOP meeting and executive SOP meeting. Each of these steps include clear actions, clear participants and assigned responsibilities, and clear communication and decision-making matrix for the process to run smoothly. All these together with S&OP prerequisites – understanding of the S&OP, time commitment of the people, technology support with data and IT tools, and determining product families, unit of measure, planning horizon, and time fences – are the cornerstone of implementing and effective usage of S&OP process.

The target of this thesis was to provide a development proposal for the sales and operations planning process of the target company. The development areas were identified by conducting a questionnaire and individual interviews for all the managers and executives involved in the target company's S&OP process. This together with monitoring the company's performance indicators provided a solid, reliable basis for doing current state analysis for the existing sales and operations planning process. Based on the current state analysis and development areas the analysis raised, a development proposal – in a form of high-level process description – was created for the target company. This development proposal does not require external resources to be used, so implementation and usage can be conducted with using only internal resources. This development proposal was delivered to the target company's executive team.

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Sales and operations planning questionnaire

Sales & operations planning at Tepcomp

The goal of this questionnaire is to evaluate the S&OP process at the management level.

1. Sales and operations planning is effective and of good quality *

Completely disagree 1 2 3 4 5 6 7 Completely agree

1/30/2022

2. Evaluate by grades 1 to 7 with your own opinion, how well below mentioned functions are handled currently regarding sales and operations planning.

7. Handled very well

1. Needs serious improvement

*

	1	2	3	4	5	6	7
Sales forecasting & demand planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supply planning (capacity, material and resource planning)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Balancing demand and supply planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Product family grouping & prioritizing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Communication between functions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Handling of necessary changes in operations to meet the plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Effective decision-making	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use of data available in the ERP	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Measuring the performance of S&OP (S&OP measures, KPI's, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

1/30/2022

3. Evaluate by grades 1 to 7 with your own opinion, how important below functions are for effective sales and operations planning.

7. Very important

1. Not important

*

	1	2	3	4	5	6	7
Sales forecasting & demand planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Supply planning (capacity, material and resource planning)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Balancing demand and supply planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Product family grouping & prioritizing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Communication between functions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Handling of necessary changes in operations to meet the plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Effective decision-making	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use of data available in the ERP	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Measuring the performance of S&OP (S&OP measures, KPI's, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

1/30/2022

4. Which of the functions needs improvement the most? *

- Sales forecasting & demand planning
 - Supply planning (capacity, material and resource planning)
 - Balancing demand and supply planning
 - Product family grouping & prioritizing
 - Communication between functions
 - Handling of necessary changes in operations to meet the plans
 - Effective decision-making
 - Use of data available in the ERP
 - Measuring the performance of S&OP (S&OP measures, KPI's, etc.)
 -
- Muu

5. What is the S&OP planning cycle currently in use? *

- Weekly
- Less than weekly, but more often than monthly
- Monthly
- Less than monthly

6. Sales and operations planning can be improved with internal actions (does not require external resources) *

- Completely disagree 1 2 3 4 5 6 7 Completely agree
-

1/30/2022

7. Sales and operations planning plays a key role in company's customer-service performance in the future *

Completely disagree 1 2 3 4 5 6 7 Completely agree
○ ○ ○ ○ ○ ○ ○

8. Sales and operations planning plays a key role in company's business performance and success in the future *

Completely disagree 1 2 3 4 5 6 7 Completely agree
○ ○ ○ ○ ○ ○ ○
