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Sales & Operations Management at Daltile

Master Thesis

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By signing this document, each member of the group confirms participation on equal terms in the process of writing the project. Thus, each member of the group is responsible for the all contents in the project.

Abstract

Forretningsplanlægning er er ikke noget ny fænomen og har alle dage været grundlag for forretningsmodeller. Sales & Operations Planning (S&OP) er ikke indbegrebet af forretningsplanlægning, men et forretningsplanlægningskoncept. Det er et koncept der har vundet bred anerkendelse over de sidste årtier. I den sammenhæng har den keramisk flise producent Daltile, med udgangspunkt i deres mexicanske hovedkontor, ønsket en gennemgang af deres S&OP, med henblik på at finde ud af hvad det næste skridt i udviklingen er. Dette studie er hyret til netop den opgave, som et led i specialeafhandling indenfor Operations and Management Engineering ved Aalborg universitet.

Denne problemstilling udledte følgende forskningsmål:

- Undersøg optimal udførelse af S&OP
- Vurdering af den nuværende udførelse af S&OP hos Daltile
- Identificer manglerne hos Daltile for at nå optimal udførelse af S&OP
- Reflekter over hvordan Daltile kan opnå optimal udførelse af S&OP

For at løse følgende forskningsmål, har der været behov for at udføre et grundigt litteraturstudie i S&OP og hvordan S&OP ser ud på forskellige stadier. Dette førte til udviklingen af en S&OP modningsmodel der har til formål at hjælpe studiet med at vise hvor Daltile er i deres modningsproces. Samme modningsmodel er også brugt til at identificere manglerne for at opnå optimal S&OP. Der blev identificeret 32 mangler. Disse mangler er blevet delt op efter modningsfaser, hvor Daltile er vurderet til på nuværende tidspunkt at være fase 2 ud af 5.

For at løse disse mangler er 13 initiativer blevet frembragt. Nogle af disse initiativer har til formål at løse mere end 1 mangel, og nogle af initiativerne vil blive foreslået til mere end 1 fase.

De 13 initiativer vil blive præsenteret som en anbefaling der er bygget op som en 3 skridt implementeringsplan. De tre skridt vil være bygget op til at opnå henholdsvis modningsfase 3, 4 og 5.

Table of content

1.0 Introduction

Planning has always been a part of doing business, also before any concept of sales & operations planning came to life. Since the beginning of business, planning has always been the key to a successful business. The first thing has always been to plan for a demand, whether it being to try to figure out how many spears to produce for the tripe hunters during the hunter and gatherer ages, or how many bathroom tiles to produce for the Mexican bathrooms in 2018. The business who could make the most accurate plan would have the better chance of having the best sales. But planning is not the same today as it was, and that is why different concepts kept being developed through the last century to optimize planning. Today planning still have the element of demand, but in a global world of minimizing costs, availability of worldwide suppliers, international private purchases, and optimizing profitability, it has just become a bit more complicated than selling spears in the local village. Today planning needs to be aligned internally with production, inventory, sales, etc. Furthermore, external collaboration with suppliers and customers can give a competitive edge against competitors. All of these aspects have been summarized into what is mostly referred to as sales & operations planning or S&OP for short. S&OP is a structured way of following a planning concept, and it is not obligatory to succeed in business. It is a tested way of conducting business, and it provides an already created framework for businesses to follow, which lowers the entry barrier for a company to start using the S&OP structure.

The goal of this project is to make a thorough investigation into S&OP according to the current literature and use the findings to assess the current S&OP at a Mexican tile company, in order to recommend possible future initiatives to the company

1.1 Aim

The aim of the project is defined as:

Based on a thorough investigation, make an assessment of the current level of sales operations planning process at the case company Daltile, as to identify, how Daltile can improve on their current situation.

1.2 Research questions

The research questions and objectives are:

Objectives	Research Questions
Investigate optimal execution of sales & operations planning	What does literature define as optimal sales & operations planning
Assess the current execution of sales & operations planning at Daltile	How is Daltile currently executing their sales & operations planning

Identify the gaps between optimal execution and current state at Daltile	What are the gaps between how Daltile executes sales and operations planning and what is described as optimal in the literature
Reflect on the how the sales & operations planning at Daltile can move toward the optimal state	What is the next step for Daltile to improve their current execution

Table 1 – Objectives and research questions

1.3 Scope of study

The themes identified as the key themes of this study is shown in Figure 1 and are used as the key themes to develop the search strings for the literature review. The search strings and methods will be discussed in section 2.8.

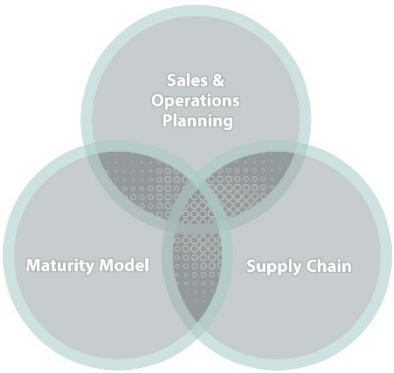

Figure 1 – Scope of study

1.4 Limitations

This study has been limited to collecting data through literature review and the logistics department at Daltile. The contact to Daltile were done through email and company visits. The planners were made available for interviews, alongside the logistic director. Due to time limitations, a second-round interview were not possible, and were therefore restricted to follow up questions per email.

1.5 Introduction to case company

The case company Daltile is a global company with its origin in Dallas, Texas, and Monterrey, Mexico. The two brothers Robert and Juan Brittingham founded it. Firstly, Robert Brittingham founded the American based Dallas ceramics company in Dallas, Texas in 1947, and in 1955 Juan Brittingham founded Ceramica Regiomontana S.A in Monterrey, Mexico. The names were changed to Daltile corporation in 1980. Daltile specializes in ceramic tiles and are the biggest ceramics manufacturer in North America and one of the biggest manufacturers in the world. In 2002 the company was acquired by Mohawk industries, which is the

world's largest flooring company, and made a part of the Mohawk Group. Today Daltile are operating 10 manufacturing facilities in USA and Mexico. The company employs over 8.500 people and have sales channels on all continents except Africa.

This project is done in collaboration with the manufacturing plant in Monterrey Mexico, where the Mexican management, and the logistic department responsible for the S&OP are located.

1.6 Reading Guide

The report is constructed through seven main chapters.

- The first has set the scene of the project, the research objectives, and questions, and given a short introduction to the company.
- Chapter two will describe the utilization of methodologies in the project
- The third chapter is the literature review, where S&OP is investigated.
- Chapter four presents the first analysis of the S&OP execution at Daltile
- Chapter five will compare the analyzed data from chapter four to the literature review in chapter three to locate any possible rooms for improvement at Daltile
- In chapter six the results will be discussed
- Chapter seven will be the conclusion of the project and the final recommendations

These seven chapters have been constructed within a project framework that is illustrated in Figure 2.

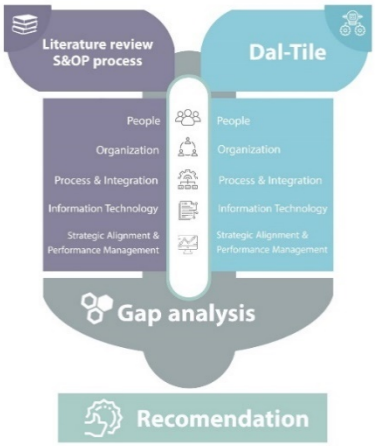

Figure 2 – Project framework

1.7 Chapter Summary

This chapter has introduced the project, described the content and the aim of the project. The following chapter will describe the methodologies used throughout the project.

2.0 Methodology

In this chapter an overview of the methodologies and approaches utilized for this project will be presented. The themes which will be investigated in the methodology is

- The research design
- The interviews
- The GAP-analysis
- The literature review framework

The research design takes point of departure in the research onion by (Saunders et al. 2008).

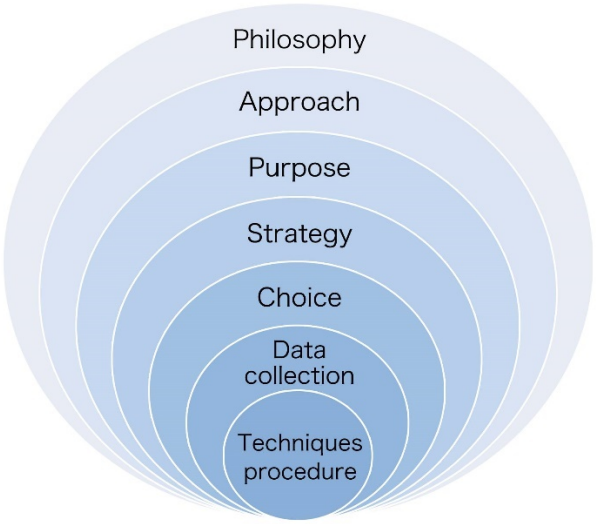

Figure 3 – Research onion by (Saunders et al. 2008)

The following sections will follow the order of the onion, see Figure 3, peeling one layer at a time, until the core of the research design.

The research is studying sales & operations planning. The subject is well described in theory and is not a new concept, which is why it will be assumed that the theory will not be radically changed.

2.1 Philosophy

This project focusses on assessing a practical problem. This means that to fully understand the issues at hand, objectivism and subjectivism have to be utilized to interpret the problem in multiple ways. This means that the project needs to be approached from a pragmatic position. Pragmatism argues that the

research questions are the most important determinant for the methods that needs to be used to answer the questions sufficiently (Saunders et al. 2008).

2.2 Approach

This is a broad investigative study, which use different approaches to different situations. Firstly, a deductive approach has been applied as the study take point of departure in the known theory about S&OP to build the framework of the study. Then the GAP analysis is based on combining these findings from the theory with the explored findings from the interview, which makes it an abductive approach.

2.3 Purpose

As this study has the task of assessing a situation and exploring what the next step is from the findings, the purpose of the study is exploratory (Saunders et al. 2008).

2.4 Strategy

An exploratory single case study research design has been used for this study. It is a single case study because it only has the focus of investigating one company (Saunders et al. 2008). The case study strategy is relevant because the research has a descriptive and exploratory focus.

Case studies can be especially useful when theory building plays an integral role, as it gives meaning to the collected data. Without the theory, the data could easily be intangible and impossible to determine good from negative results, making an assessment impossible (Saunders et al. 2008).

2.5 Methodological Choice

The methodological choice needed to analyze this study has been the multi-method qualitative study. The multi-method qualitative study was chosen as both literature review and interviews are being conducted as means of data collection. In practice, the literature review will be used to define the essential data needed to conduct this study, whereas the interviews have been conducted to bring forth this data. The data collection has been focused on being qualitative, because it opens the data collection to more elaborate data than a quantitative data collection. The choice is illustrated in Figure 4.

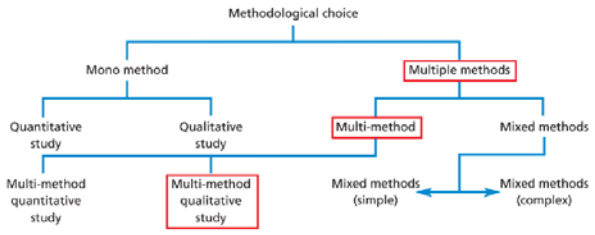

Figure 4 – Methodological choice

2.6 Data Collection

This study has collected both primary and secondary data to help investigate the research questions. The definition of primary data is data collected with for the specific purpose of this study, whereas secondary data is data collected for another purpose, and being reused (Saunders et al. 2008).

2.6.1 primary data

The primary data consists of non-standardized semi-structured interviews[1]. Semi-structured means that the interviews are conducted with a prepared interview guide, with a set of open ended questions. The interview guide will serve as an aid to the interviewer, but the interviewer is not bound by it, and can therefore explore deeper explanation and new subjects the interviewee brings up, see appendix A. The interview form is chosen because it is well suited for exploration and explanation (Saunders et al. 2008). Figure 5 illustrates the chosen interview form.

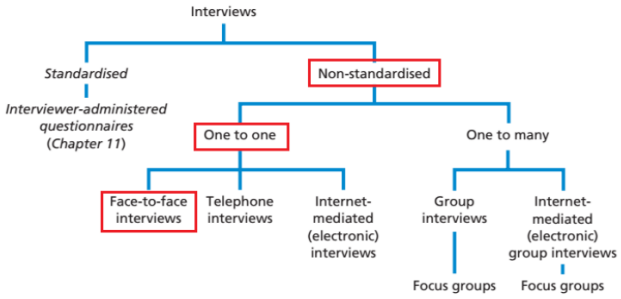

Figure 5 – Non-standardized semi-structured interviews (Saunders et al. 2008)

2.6.1.1 Interview Sampling

The sample was possible to choose for the author, but limited to the logistic group present at Daltile Monterrey, which was only three persons, which by default took away the choice. The sample consisted of the director of the department, a planner, and the planning superintendent, who is considered the S&OP champion. This mean that the sample was a highly homogenous population.

(Saunders et al. 2008) suggest that when saturation is accomplished, and little new information will be provided by more interview, the sample is sufficient. According to (Saunders et al. 2008) the minimum size for a homogenous population is four see Figure 6.

This means that the sample does fall one short of the minimum, but at the same time the answers were so similar that the evaluation of the author is that little new information would have been provided with a

[1] Audio files are available upon request

larger population from this department. This means that the interviews have been utilized, but with the notion that the sample size is critically low.

Nature of study	Minimum sample size
Semi-structured/In-depth interviews	5–25
Ethnographic	35–36
Grounded Theory	20–35
Considering a homogeneous population	4–12
Considering a heterogeneous population	12–30

Figure 6 – number of samples (Saunders et al. 2008)

2.6.2 Secondary Data

The secondary data in this study is collected mainly through journals, books, published works, and articles to find relevant theory for S&OP. The literature review process will be described thoroughly in section 2.8.

2.7 Techniques and Procedures

2.7.1 Interviews

There has been conducted three interviews with all members of the logistic department involved in S&OP at Daltile Monterrey. The interviews took on average approximately 50 minutes. A meeting room at the Daltile plant was assigned to the interviews. The interviewer followed the interview guide from appendix A. The interview guide provided a list of open ended about S&OP, the execution of S&OP and how they saw the role of employees and top management in the S&OP process. The interviews were followed up by a list of open ended questions, sent by email to the participants, these are listed in appendix B. The interviews were recorded by smartphone, and both round of interviews is summarized in appendix C.

2.7.2 Data Analysis Techniques

The data analysis technique used is a type of pattern matching, which means a pattern of outcomes are predicted based on theoretical propositions to explain what is expected to be found (Saunders et al. 2008). Pattern matching has been used in this study, by creating a pattern based on the literature review. This pattern has then assisted in reading the data analyzed in chapter 4.0, and set the point of departure in making the GAP analysis in chapter 5.0. The difference between the pattern matching technique used and the pattern matching technique described by (Saunders et al. 2008) is that the original technique will take the predicted pattern, compare it to the findings and then determine if the prediction is true or false. In this study, pattern matching has been utilized to determine where the predicted pattern (the theory) will provide the foundation of the investigation, which will be of what is needed for the findings to match the pattern.

2.7.3 Credibility of Interviews

The methodological choices throughout the gathering of the data have been made with full transparency, as to provide validity to the study. Potential pitfalls of semi-structured interviews are acknowledged such as not getting the same findings and too small a sample size, however these have been the study clearly describes how the results of the conducted data were found, and therefore the findings are valid and can be utilized further on.

Limited access to the company can have affected in-depth knowledge and left out different views, but at the same time it has limited the possibility of researcher bias, since the company did not have the possibility to force any desired findings on the research.

There might be a possible reliability issue due to the limitations. This possible liability is the inaccessibility of interviews with participants from other departments, which might have provided a different perspective.

The interviews were conducted in a relaxed environment, in an isolated conference room. The interviewer felt that the participants could speak freely and were willing to comply. There was a possible language barrier, since none of the participants have English as their first language, but the interviewer felt that when this was an issue, it was easily remedied with either a rephrasing of the question, or a quick Spanish translation of the question. The interviewees seemed to get their points well across in English.

2.8 Literature Review Framework

Since the literature review is the element this study is based upon, optimal credibility has been sought through a thorough review model. The framework has been illustrated in Figure 7.

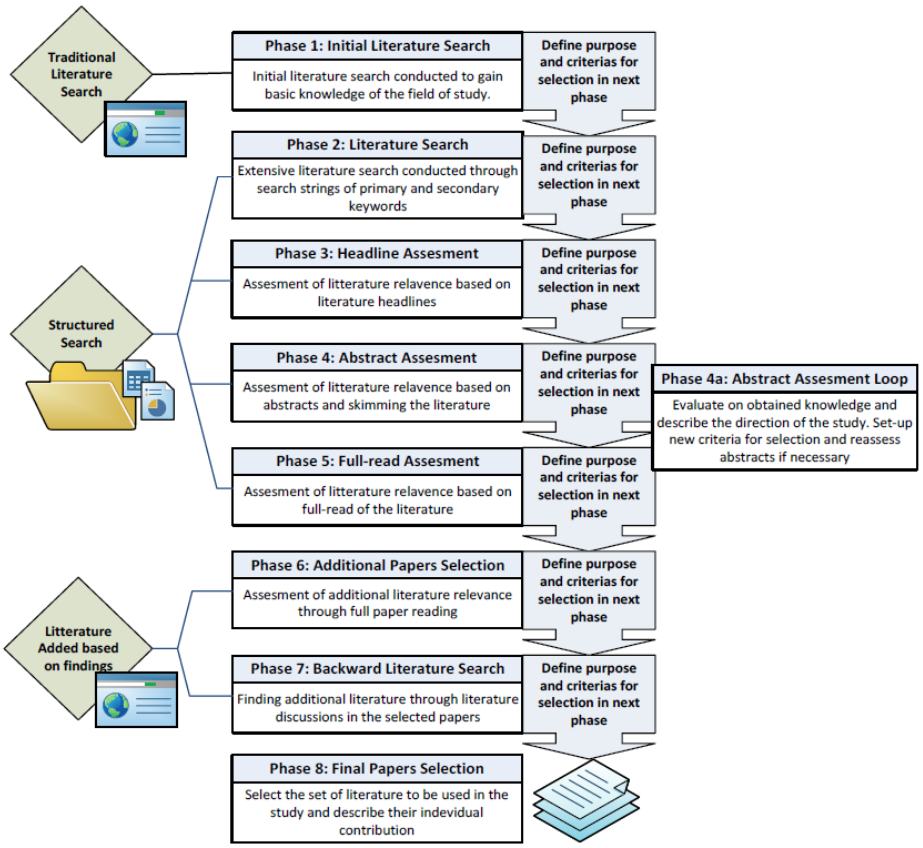

Figure 7 – Literature review framework

The literature review and its framework are primarily a deductive approach as it will explore the theory on the subject of the study. Although the first phase, the initial literature search, will be inductive part of the literature search to create the foundation of defining the search strings to describe key elements of S&OP. After the strings have been defined, they will not change. Whereas phase one is inductive and open, phase two will be a search based solely on the search strings. After phase two, the criteria for selection will be narrower for each phase, as to filter the literature search.

The purpose of this framework is to give full transparency of the literature search throughout the study make the process of narrowing down the literature more comprehensible for both reader and researcher (Tranfield et al. 2003). This will ensure the reliability as another researcher applying the same decisions would end up with the same results.

2.8.1 Phase One Initial Literature Search

This phase clarifies the scope of the study and is highly influential of the entire framework.

2.8.1.1 Define scope

First part of the initial literature search was to define the scope. The scope identified for this study was three elements. The three elements are sales & operations planning, maturity, and supply chain. As to elaborate on the scope of the study a brainstorm was conducted. The result of the brainstorm is shown in Table 2.

Scope	Elaboration (Body of knowledge)	Contribution to the study
Sales and operations planning	Planning, aggregate planning, IBP, S&OP	Main element of study: What is the purpose of S&OP, what are the essentials of S&OP, what is the development, what is the way forward
Maturity	Experience, culture, alignment	How can the level be assessed, what are the stages, what is the next stage
Supply chain	Collaboration, suppliers, customers	What is the role of the supply chain

Table 2 – Brainstorm

After the scope was defined and elaborated through the brain storm, the initial search was commenced. The aim of the initial search is to give fundamental knowledge of the subject. This is necessary to understand a broader perspective of the scope as to create relevant search strings for the literature review. The initial search was conducted on broad and common search engines like google.

2.8.1.2 Literature search

Firstly, the sources for the search of literature were identified. The sources are shown in Table 3.

Database	Link	Used for
Primo	http://www.aub.aau.dk/	Initial search for every string
ABI/INFORM collection	http://search.proquest.com/abicomplete?accountid=8144	ABI Inform covers management theory, business trends, management techniques, human resource management, marketing, business, accounting, finance

Table 3 – Databases used

Thereafter, the search strings were created for the further literature review. The strings are based on the body of knowledge obtained from the initial search. The strings were giving a string number, a title, primary keyword(s), secondary keyword(s), and a contribution to the study. The strings are showed in Table 4.

It might be noticeable that some of the titles are identical, but this is caused by minor differentiations in the primary and/or secondary keyword(s). These minor differences are created to embody as much of the relevant literature as possible.

String no.	Title	Primary Keyword(s)	Secondary Keyword(s)	Contribution to the study	other search specifications (e
	general for all strings				Danish and English language, Peer-reviewed
1.	General knowledge of S&OP	("S&OP" OR "Planning" OR "Operations planning" OR "Sales & operations planning" OR "Sales and operations planning")		General knowledge of S&OP	
2.	General knowledge of IBP	("IBP" OR "Integrated business planning")		General knowledge of S&OP	
3.	General knowledge of Planning	("S&OP" OR "Planning" OR "Operations planning" OR "Sales & operations planning" OR "Sales and operations planning" OR "IBP" OR "Integrated business planning") AND ("supply chain" OR "Manufacturing" OR "ERP")		General knowledge of S&OP	
4.	Knowledge about the different levels of S&OP	("S&OP" OR "Planning" OR "Operations planning" OR "Sales & operations planning" OR "Sales and operations planning" OR "IBP" OR "Integrated business planning")	AND ("Maturity" OR "maturity model")	How to measure maturity of S&OP, how to create a path for improvement	
5.	Knowledge about the different levels of S&OP	("S&OP" OR "Planning" OR "Operations planning" OR "Sales & operations planning" OR "Sales and operations planning" OR "IBP" OR "Integrated business planning") AND ("supply chain" OR "Manufacturing" OR "ERP")	AND ("Maturity" OR "maturity model")	How to measure maturity of S&OP, how to create a path for improvement	
6.	Standards of S&OP	("S&OP" OR "Planning" OR "Operations planning" OR "Sales & operations planning" OR "Sales and operations planning" OR "IBP" OR "Integrated business planning")	AND ("implementation")	How can S&OP be implemented, what is needed	
7.	Standards of S&OP	("S&OP" OR "Planning" OR "Operations planning" OR "Sales & operations planning" OR "Sales and operations planning" OR "IBP" OR "Integrated business planning") AND ("supply chain" OR "Manufacturing" OR "ERP")	AND ("implementation")	How can S&OP be implemented, what is needed	

Table 4 – Search strings

Two tables were created to clarify the development of the study. The first table as seen in Table 5 shows the funneling of papers through the different phases for each string.

No. Of papers selected							
String n	Title	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
1		41	29	19			
2		13	9	5			
3		28	4	2			
4		21	7	4			
5		35	12	4			
6		25	7	4			
7		38	10	6			
	Additional papers	0	0	0	4	8	
Total		201	78	44	4	8	56

Table 5 – Papers selected in each phase

Shown in Table 6 is the criteria applied to the different phases.

Criterias for selection				
String r	Criteria	Phase 3	Phase 4	Phase 5
1.	all strings	Only selecting articles relavant to the string and brainstorm elaboration	Only selecting articles contributing to elaborate on general knowledge, trends, maturity, and implementation in relation to S&OP	Rating (1-5; 1=not relavent , 3=little potential , 5=great potential)

Table 6 – Selection criteria

It was determined for phase one to include the first 200 results of each string, as the relevance after the first 200 seemed to diminish, and resources would be better applied elsewhere.

2.8.2 literature selection process

This section will describe the selection process more detailed. Phase three, four, and five are the next phases to be conducted. Firstly, phase three was to make a headline assessment of the 200 articles found in each string. This created a result of 201 headline approved articles across the strings as seen in Table 5. These where then abstract approved in phase 4, resulting in 78 articles. The 78 articles were then full read assessed and rated 1-5 for expected contribution. Only articles rated 4 and 5 were selected for the study.

Additional literature was added after the literature review was conducted, as part of unstructured searches, this is phase six of the literature framework Figure 7. Finally, at phase seven, backwards literature search was conducted. Backwards literature is a search of the references which was found interesting in the assessed literature.

Phase 8 is the list of all the literature that is selected for the study.

The tables containing the results of all the phases of the literature search can be accessed in appendix D.

2.9 Chapter Summary

This chapter has discussed the methodology used for this study and reflected upon its choices, reliability, validity, and data collection methods. The framework of the literature review has been described and will cover the next chapter of the study.

Figure 8 shows the academic choices of this study.

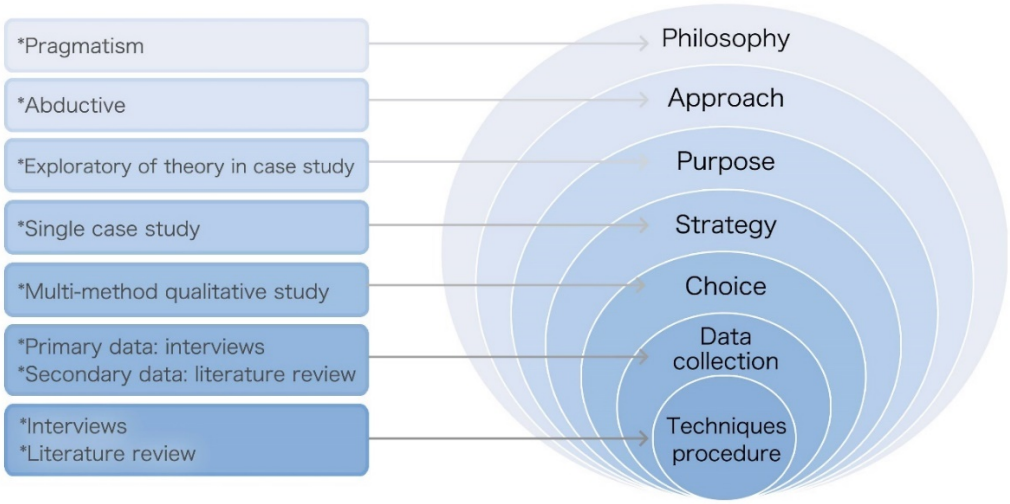

Figure 8 – Overview of the methodology choices utilized

3.0 Literature Review

As showed in Figure 9 this chapter will embody the findings from the literature review and determine how best to assess a company's S&OP process, infrastructure, and execution according to the literature. There are no shortage of literature considering S&OP and it has therefore been surprising how homogenous the content of the literature has been on the subject. A sign of the homogenous level of the articles, is that most article uses the same references. The combination of a great number of articles and not much differences in the articles, have resulted in the literature review referring to a few different articles during this chapter, as the chapter will not refer to several articles for the same point. All articles deemed relevant by the method, see section 2.8, will be presented appendix D.

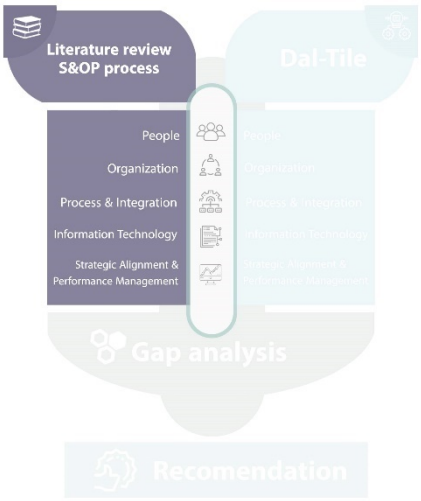

Figure 9 – Project framework literature review

Because of the homogenous literature, it has been possible to create a fairly simple structured literature review, that will start with defining S&OP and the building blocks within, starting with a historic development that led to the current view and execution of S&OP. This view will be summed up in a S&OP model, which will break down the different key mechanisms of S&OP. The definition of S&OP will round up with execution of S&OP where the actual current execution will be explained step by step, as it is recommended in the literature.

When S&OP has been explained, the next section will then go through how the S&OP can be assessed within a company according to the literature. This will be through a maturity model, and here the literature has several different maturity models, but a single has been chosen to be outlined in this literature study, as it is the basic of which most maturity models in the literature are constructed. The different models are mostly different in name of the maturity stages and/or the dimension, but the content is basically the same.

The chapter will round up with a summary of what the key findings are. The key findings in this chapter will then be used in the following chapters as to answer the research questions this report is based on.

3.1 Sales and Operations Planning

This section will describe the concept of Sales and Operations Planning (S&OP) according to literature. Starting with the development in planning throughout most of the second part of the last century, until

today. Furthermore, this section will give an insight in what literature describes as the basic building blocks of a modern S&OP. These building blocks will then be used as basis to describe the S&OP model build by (Tuomikangas & Kaipia 2014). This model will be broken down into key mechanisms, which will be described in that part of the section. Lastly in this section the execution of S&OP will be examined as to give an understanding of the sequence in which S&OP is conducted.

3.1.1 The Development of Planning

S&OP is a planning process, also known as aggregate planning. S&OP is a responsive planning process, that returns the communication two way.

Whereas the earlier versions of planning starting with Shop Floor Control (SFC) only focusing inwards on how to optimize machines and outputs (Olhager 2013).

In the 70's Material Requirements Planning (MRP) were introduced. Planning became more systematized, and the use of Bill of Materials (BOM) meant that subassemblies did not need to be forecasted independently, since it is a dependent demand from a higher-level product or end user product (Olhager 2013).

During the 80's came Master Production Scheduling (MPS), which gave a shift in paradigms on how operations could be more efficient and effective. This came along with the publication of the Toyota Production System, that introduced the world for Just-In-Time (JIT) and Kanban. Rather than only optimizing the operations from the offset that a set of constraints are given, the Theory of Constraints (TOC) questioned the given constraint and started the thinking of changing basic characteristics of the production system, such as quality improvements, reducing- setup times, lead times, bottlenecks, and lot sizes (Olhager 2013).

The term S&OP began in the 90's where MPS and MRP systems were rebranded as Enterprise Resource Planning (ERP) with increased information and communication technology. This paved the way to S&OP. S&OP is characterized by long term planning of sales and production relative to demand forecasting and resource capacity planning. The new features of S&OP were planning in product families and having a longer plan horizon (15-18 month). This made it possible to plan and evaluate investments in production

resources with longer acquisition time, and with a respect for the plans for sales, operations, inventory, and backlogs. S&OP is defined by having two pure strategies, Level and Chase (Olhager 2013).

The 2000's had more and more companies realizing that the S&OP that only focused internally for the optimization and efficiency were no longer sufficient to compete successfully on the global market. Thus, started the focus for S&OP to optimize the whole supply chain (Olhager 2013).

This historical development is not a replacement development, but instead a continuously built-on development, and Figure 10 illustrates the coherency between the four development levels.

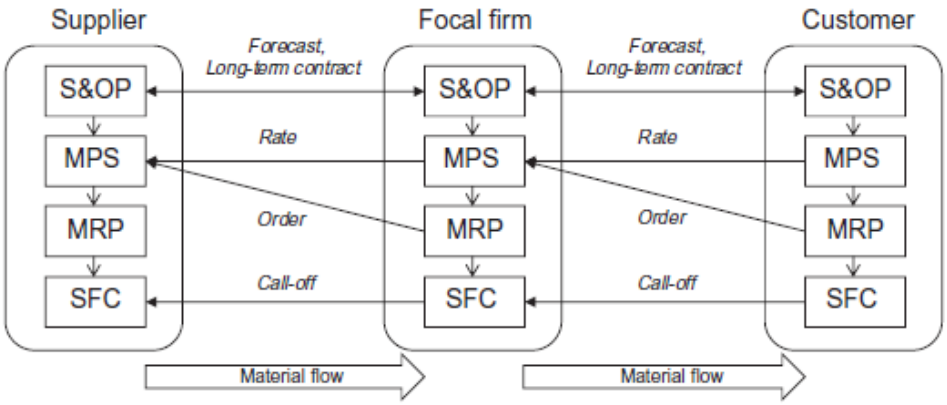

Figure 10 development in planning process (Olhager 2013)

3.1.2 Sales and Operations Planning

S&OP is a process to make the tactical plans within the overall company strategy for every business area of the company, and during this process the executive level management meets and review projections for demand, supply, and the financial impact that result thereof (Murray 2016). Because S&OP includes all the business areas, it will help overcome silo thinking, which will increase the ability to stay relevant in highly competitive markets (Danese et al. 2017). The result of the S&OP will therefore be a single operating plan to allocate the resources of the company, such as time, money and employees (Murray 2016). The main reason to allocating resources should always be to increase customer value (Hulthén et al. 2016). This means that S&OP is used to balance demand and supply and give early indications as to where a potential imbalance can be found (Hulthén et al. 2016). S&OP is currently more important than ever, because of the increasing complexity of planning and control tasks such as: Demand for lower lead time, need for more efficient utilization of bottlenecks, and the shortened lifecycle of products (Olhager 2013). According to (Scavarda et al. 2017) S&OP consists of four main building blocks that functions as to bridge the business/strategy plans with operations.

The four building blocks are explained in Table 7:

Building block	Contextual	Input	Structure and process	Outcome/ results
Explanation	The environment in which the S&OP is immersed.	From the context the data is generated to create inputs that will be the foundation of the structures and processes.	An integrated set of plans that leads to profit optimization and feedback to the inputs. This building block can be divided in three sub assignments	The outcome is the final integration of the plans created, resulting in a profit optimization
Examples	• Country • Industry • Manufacturing strategy • Planning horizon	• Forecast • Functional plans • Operational constraints • Inventory • Budgets • Costs	• Meeting & collaboration • Organization • Information technology	

Table 7 - The four building blocks according to (Scavarda et al. 2017)

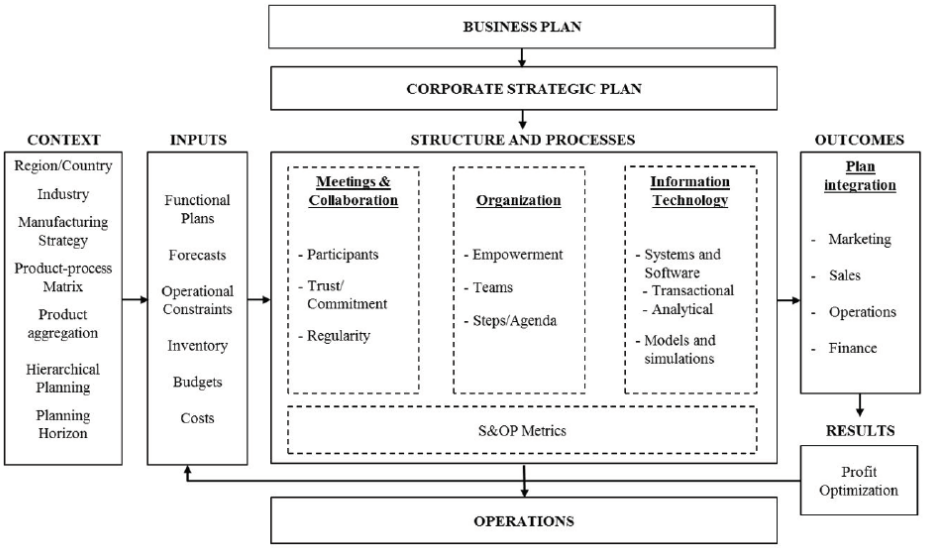

Figure 11 - The framework from (Scavarda et al. 2017)

This has led to (Tuomikangas & Kaipia 2014) breaking down the build of S&OP into eight mechanisms, that is pointed out as central for the coordinating a S&OP process.

3.1.2.1 Structure & Centralization of Decision Making

The first mechanism is based on how S&OP should be configured within the conceptual framework. Studies by (Kjellsdotter Ivert & Jonsson 2015) has shown that a centralization of organizational planning combined

with the plans for supply and demand, could create benefits such as creating what-if scenarios and analyzing future events (Tuomikangas & Kaipia 2014).

3.1.2.2 Formalization and Standardization

The second mechanism is the need for a formal S&OP process, with meetings and schedules. This means developing standard operating procedures for dealing with complex tasks and create a companywide plan. This can be obtained through accurate time planning, standard meeting agendas, a S&OP manual, training, S&OP certificates, and an internal S&OP community (Tuomikangas & Kaipia 2014).

3.1.2.3 Planning and Data Management

The third mechanism is the planning and management of data. This mechanism has three focus points. Firstly, it focusses on the input data's use and quality. Meaning that the data format is the needed format, a data hierarchy is correct, real time data. Accuracy, quality, and availability of the data is needed for a successful S&OP. The second focus is to adopt the correct IT tools, such as a platform that helps fulfill the planning need e.g. Enterprise Resource planning (ERP) systems. The third focus is to manage uncertainty, by making a set of sub-plans, this is also known as scenario planning, risk planning or simulation. This is a way to prepare for when the expected outcome do not turn out as expected, usually due to lack of accuracy in the forecast (Tuomikangas & Kaipia 2014).

3.1.2.4 Output and Behavior Control

This mechanism relates to controlling behavior, which can be done through performance measuring. Installing good S&OP behaviors is a way to enhance integration and can ensure that all is working with the same goal. Some way of ensuring everyone is working toward the same goal, can be to incentivize them through KPIs, creating joint process developments, benchmarking against competitors, and doing process audits (Tuomikangas & Kaipia 2014).

3.1.2.5 Intraorganizational Relations

The fifth mechanism is related to the collaboration between departments. It is widely recognized in the literature that a prerequisite for succeeding with S&OP, is for the organization to be cross-functional, have a process owner, and be supported by top management. Furthermore, it is important for the design of the organization to be aligned with the needs of the operations of the S&OP process (Tuomikangas & Kaipia 2014).

3.1.2.6 Interorganizational Relations

The sixth mechanism is about relations to collaborating companies. It is possible to assist the S&OP process in many aspects by having tight collaborations all through the supply chain. Some examples of what can be

achieved by increasing the level of information that flows between entities within the supply chain are Collaborative Planning, Forecasting, and Replenishment (CPFR) and Vendor-Managed-Inventory (VMI). it is widely indicated in the literature that the S&OP performances of a firm improves when the information systems favors supply chain integration (Tuomikangas & Kaipia 2014).

3.1.2.7 Informal Communication

The seventh mechanism is the least discussed in the literature, and according to (Tuomikangas & Kaipia 2014) this is an indicator that S&OP is understood as a formal process with predetermined practices and meetings.

3.1.2.8 Socialization

The eighth and last of (Tuomikangas & Kaipia 2014)'s mechanisms is the mechanism that relates to the importance of creating a common company culture. The literature speaks of creating common culture by top management setting the example and not only dictate the S&OP, but also actively participating and supporting (Hulthén et al. 2016). S&OP is described as a highly social process that involves cooperation from individuals, functions, and other companies. This requires data sharing, communication, and a strive for collective success. This is considered a critical success factor to perform S&OP (Tuomikangas & Kaipia 2014).

3.1.3 S&OP Model

(Tuomikangas & Kaipia 2014) interpreted these eighth key mechanisms and created a framework with six coordination mechanisms. These six coordination mechanisms are S&OP organization, S&OP process, S&OP tools and data, Performance management, Strategic alignment, and S&OP culture and leadership. Thereby creating the model seen in Figure 12.

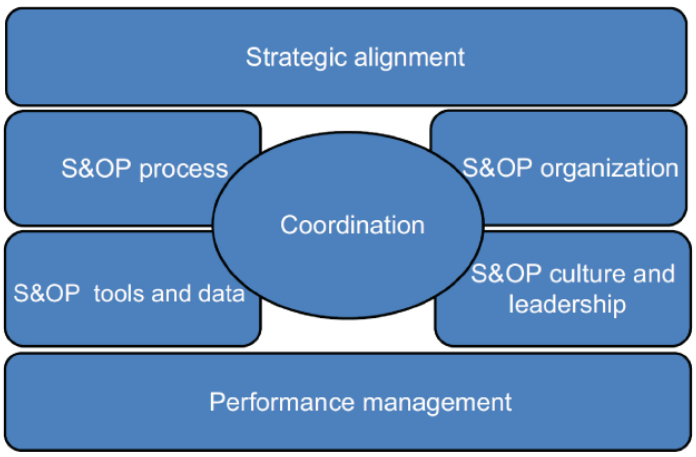

Figure 12 - (Tuomikangas & Kaipia 2014) *S&OP coordination framework*

3.1.3.1 Strategic Alignment

The strategic alignment is the vertical link between the long-term strategy and the short-term operational tactics. According to (Tuomikangas & Kaipia 2014) there are two perspectives of the long-term strategy, firstly the overall business strategy, secondly the production strategy. The perspective of aligning short-term tactics with long-term overall business strategy is according to the framework done by (Thomé et al. 2012) a vertical positioning of S&OP between the corporate strategy and the operations, as seen represented in Figure 11 as the building blocks of S&OP, where the contexts, inputs and outputs are considered. Furthermore (Olhager 2013) explains that an efficient alignment between the business strategy and the S&OP significantly improves the firm performances.

As for the alignment between short-term operational tactics and long-term production strategy, it is seen as an alignment of the S&OP with the capacity strategy. According to the framework made by (Olhager et al. 2001) the capacity strategies is pronounced through the capacity levels and expansion/reduction strategies, whereas the S&OP is pronounced through the planning strategies of production relative to sales, inventory, and backlogs.

3.1.3.2 S&OP Process

The S&OP process can be interpreted as a dynamic collaborative planning and decision process, that starts with being reactive, with silo thinking, no formal collaboration, no formal planning, no formal meetings. Then as the process matures, it moves towards advanced and proactive planning, and the S&OP process starts to formalize and integrate with both internal and external collaborations. The mature S&OP process can therefore be seen as a collaborative planning process, with collaboration downstream, interdepartmental, and upstream. Other key areas are decision making for manufacturing planning and marketing & sales planning, developing long range forecasts for demand, sales plans, promotion plans, and determining long term capacity requirements and production plan, collaborative demand and supply planning. So, the more mature the S&OP process gets, through collaboration, the less performance will be infringed upon by issues like conflicting functional goals of the different departments, or by integration of different sup-plans.

3.1.3.3 S&OP Tools and Data

Although literature talks about technology as a key enabling tool, there is a broad consensus, that in the early stages, it is sufficient with a simple setup such as spreadsheets, instead of an elegant and expensive IT tool. Thereby leaving the focus on establishing the proper process first, and then as the process matures towards advanced and proactive S&OP, the need for a more complex tool increases (Kjellsdotter Ivert & Jonsson 2015). It is also made clear that a potential IT system should provide interdepartmental

transparency with data access for the entire S&OP organization, see the following chapter 3.1.3.4. The introduction of an IT system should provide improvements to the decision support and the planning efficiency (Tuomikangas & Kaipia 2014).

The data requirements for S&OP is that it is shared and consolidated, but in reality, the S&OP at early stages is more often than not individually owned without any consolidation. As the S&OP matures it is shared and consolidated, and at the advanced and proactive S&OP stage it includes real-time data and external data from suppliers and customers. It is very that the bare minimum is that the data is correct, updated, and trustworthy (Tuomikangas & Kaipia 2014).

3.1.3.4 S&OP Organization

The S&OP organization is normally referred as having four different supply chain departments: Procurement, Production, distribution, and sales. These four departments have traditionally been managed independently, without interacting with the other department. This has been with the argument that decentralizing the decision making, the complexity of each decision is lessened. The result however, have also limited the potential of cost reduction and profitability, and therefore companies have moved to structure their supply chain with more control, coordination and integrated planning (Tuomikangas & Kaipia 2014). Besides looking at the centralization level of the supply chain departments, the literature also talks about the meetings and decisions being made either locally, regionally, or globally. Just as centralizing the departments' decision making can provide higher potential cost reduction and profitability, so can centralizing different local sites, making regional or even global decisions (Kjellsdotter Ivert & Jonsson 2015). But as well as with collaborating with the different departments creates higher complexity, so does centralizing sites, maybe even in a higher degree.

Another important part of an S&OP organization is the roles and responsibilities of the participants in the decision-making meetings. According to (Tuomikangas & Kaipia 2014) the participants all have specific tasks and activities, for which they are responsible. These tasks are carried out in coordination with predefined schedules that are aligned with the overall S&OP time plan. S&OP also demands shared activities, where the different functions are validated together. It is also in these activities, where a consensus is made on forecasts. To obtain a high level of commitment and compliance, it is important that all the participants shows involvement and collaboration (Hulthén et al. 2016).

3.1.3.5 S&OP Culture & Leadership

The organizational mindsets and practices of a S&OP company needs to facilitate and advance the formal planning. (Tuomikangas & Kaipia 2014) identifies the following perspectives to do so: Aligning objectives, rewards and incentives, top management ownership, collaborative manner, and empowerment.

Aligning objectives means that the organization have common business objectives across functions, which are communicated clearly to the organization. The purpose is to guide the decision-making process, and close gap that are present in the process. With a more mature S&OP the alignment will also cover external collaborators (Pedroso et al. 2017).

Rewarding and incentive systems, should collaborate towards the common goal, and not contradict as to fulfill a single department (Hulthén et al. 2016). The best way to ensure this is with **top management ownership** as to ensure departments collaborates instead of only seeing their own success (Swaim et al. 2016). Top management involvement increases with the maturity of the S&OP process (Hulthén et al. 2016). This will require a **collaborative manner**, that demands trust horizontal across functions and vertical across hierarchical level, commitment to the plan, and a strive for consensus (Tuomikangas & Kaipia 2014). Another key cultural requirement needed is the **empowerment** of the employees, as to make them participate actively throughout the S&OP process (Hulthén et al. 2016).

3.1.3.6 Performance Management

Performance management is the measuring of critical success factors. Performance measures are an important and efficient way to control and direct all the coordinating mechanisms of the S&OP model, since it is where the results are measured.

According to (Tuomikangas & Kaipia 2014) Performance management can be divided into 3 subcategories: Financial performance, operational performance, and process performance.

Financial performance includes logistic and manufacturing costs, revenue, optimizing profits, costs, and economic value added.

Operational performance, which includes order fill rate, delivery speed, delivery reliability, quality, forecast accuracy, inventory volume flexibility, and product mix flexibility

Process performance includes proposed improvements to decision support, planning efficiency, learning affects.

Whereas financial and operational performance can be measured more simple through numeric quantitative data, process performance is more complex and will usually need to be assessed through audits and continuous improvement efforts (Tuomikangas & Kaipia 2014).

3.1.4 Execution of S&OP

To execute a S&OP setup a company usually goes through five steps. Initial to starting these steps is to determine what the planning horizon will be. Planning horizons usually ranges from 6 months to 3 years.

Planning horizons can vary both from industry to industry or from product to product, but a rule of thumb is that long production lead times and high seasonality will prefer longer planning horizon, while shorter lead time and low seasonality will opt for shorter planning horizons (Grimson & Pyke 2007).

The first step is pre-meetings at the sales department, who meet to make an unconstraint sales forecast based on what they believe the company can sell within the next planning horizon. The forecast will also take in to considerations expected responses to marketing plans such as trade shows, promotions, etc. The result from the first step will be a consensus-based demand forecast for the planning horizon, not considering what can be produced, but solely on what can be sold (Grimson & Pyke 2007).

The second step is also pre-meetings, but by the operations department. The operations team gather information on supply chain capacity, inventory strategy, and internal capacity. This information is used to create a picture of the of future plans and requirements. Furthermore, the team uses the result from the first step, to create an initial supply chain plan, designed to meet the demand forecast (Grimson & Pyke 2007).

The third step is when the S&OP team formally meets and develops the actual operating plan for the next period. In order to optimize the result, two key factors have to be fulfilled.
The first key factor is the personnel on the S&OP team. The team must be cross-functional and must have members of *sales and marketing*, to represent the demand management and forecasting; *operations,* to represent procurement, inventory management, supply chain scheduling, etc.; and finance. The number of personnel at these meetings will vary from company to company, for example (Hahn & Kuhn 2011) reported that Hyundai had up to 30 people involved in their meetings. To improve S&OP effectiveness a S&OP champion should participate in these formal meetings. Companies should determine a skillset that is needed to be a champion, and then either develop employees to be champions or hire personnel with the determined skillset. Furthermore, there should be senior executives present, to review and approve the work of the pre-meetings, and can grant authority to the S&OP team, so the team can implement decisions (Grimson & Pyke 2007).
The second key factor is the meeting frequency. The S&OP team needs to formally meet at a regularly scheduled interval, and most literature recommends an interval of one month. The literature indicates that the more mature the process, the more regularly the formal meetings, having examples of as regularly formal meetings as daily. When it comes to daily meetings, there are some opposition, as some authors feel it will cause instability in the production process (Grimson & Pyke 2007). According to (Grimson & Pyke 2007) the leading S&OP are striving towards replacing the regularly meetings by making the S&OP process

an event driven S&OP process. This means that the meeting should be on an as needed basis, such as competitor actions or operations problems.

The fourth step is to distribute and implement the plan. The primary drivers during the implementation are the sales and operations teams. However there seem to be a tendency that it is up to the operations team to actually reach the acquired targets, whereas the sales team is rarely expected to adjust sales plans (Grimson & Pyke 2007)

The fifth step is measuring the results and the effectiveness of the S&OP execution. The measurements will form the basis for continuous improvements. According to the literature, the chosen measures will vary according to industry, process, and product line. Examples of measurements was given in section 3.1.3.6 (Grimson & Pyke 2007).

3.2 S&OP Maturity Model

The most referenced maturity model in the literature was the framework created by (Grimson & Pyke 2007). At the same time most maturity models created afterwards seem to emulate this model, and/or reference to it as the base concept. This is the reason this model has been chosen as the reference in assessing S&OP maturity. The model uses five S&OP measuring dimensions, which it divides into five maturity stages. The five measuring dimensions are meetings & collaboration, organization, measurements, information technology, and S&OP integration. The first three dimensions are primarily business dimensions whereas the last two are information processes. The five maturity stages are stage 1 no S&OP processes, stage 2 reactive S&OP processes, stage 3 standard S&OP processes, stage 4 advanced S&OP processes, stage 5 proactive S&OP processes. The literature does have a consensus that although some elements of stage 5 may be present, there are no examples of companies being able to consider themselves a stage 5 maturity. This section will describe how the dimensions will be assessed and fit in the five stages. The framework is displayed in Figure 13

	Stage 1 No S&OP Processes	Stage 2 Reactive	Stage 3 Standard	Stage 4 Advanced	Stage 5 Proactive
Meetings & Collaboration	• Silo Culture • No meetings • No collaboration	• Discussed at top level management meetings • Focus on financial goals	• Staff Pre-Meetings • Executive S&OP Meetings • Some supplier / customer data	• Supplier & customer data incorporated • Suppliers & customers participate in parts of meetings	• Event driven meetings supersede scheduled meetings • Real-time access to external data
Organization	• No S&OP organization	• No formal S&OP function • Components of S&OP are in other positions	• S&OP function is part of other position: Product Manager, Supply Chain Manager	• Formal S&OP team • Executive participation	• Throughout the organization, S&OP is understood as a tool for optimizing company profit.
Measurements	• No measurements	• Measure how well Operations meets the sales plan	• Stage 2 plus: • Sales measured on forecast accuracy	• Stage3 plus: • New Product Introduction • S&OP effectiveness	• Stage 4 plus: • Company profitability
Information Technology	• Individual managers keep own spreadsheets • No consolidation of information	• Many spreadsheets • Some consolidation, but done manually	• Centralized information • Revenue or operations planning software	• Batch process • Revenue & operations optimization software – link to ERP but not jointly optimized • S&OP workbench	• Integrated S&OP optimization software • Full interface with ERP, accounting, forecasting • Real-time solver
S&OP Plan Integration	• No formal planning • Operations attempts to meet incoming orders	• Sales plan drives Operations • Top-down process • Capacity utilization dynamics ignored	• Some plan integration • Sequential process in one direction only • Bottom up plans - tempered by business goals	• Plans highly integrated • Concurrent & collaborative process • Constraints applied in both directions	• Seamless integration of plans • Process focuses on profit optimization for whole company

Figure 13 - Maturity framework by (Grimson & Pyke 2007)

3.2.1 Meetings & Collaboration

Meetings & collaboration is essentially the measurement of the employees' effectiveness in S&OP.

At **stage 1** there are no formal meetings and the departments do not collaborate with each other. Some of the usual characteristics with no collaboration between the sales and operations department is that sales personnel work independently and only interacts when customers complains over late deliveries, etc. and they do not use their knowledge to create a forecast. For operations that usually entail, that they take what information they find and try to make a forecast themselves to meet demand. This easily creates a downward spiral, where sales begin to inflate their demand to overcompensate for operational issues, whereas operations deflate numbers to compensate for sales numbers being inflated. At the same time both groups then can end up with goals from the finance department that have been developed without a clear understanding of the market, productions capacity, or inventory positions. This will then again contribute to the negative spiral and making both sales and operations run at a wrong pace, needing to adjust numbers.

In **stage 2** meetings have started, but at a senior management level. This usually means that the focus is on financial goals, and therefore the silo mentality persists, since there is no collaboration under the senior management level. The focus on the financial goals are at the cost of actually looking to integrate plans. The risk is that the focus on financial goals, will drive the sales effort, promotional activities, and pricing strategies without a clear understanding of the true effects on the market or operations. Another risk of having financial goals and sales forecast drive the operation, is that it usually means that operations has to

adjust their plan to accommodate inaccuracy in the sales forecast, whereas sales are exempt of accountability for an inaccurate forecast. This can lead to the sales department inflating the numbers, as to ensure a higher availability, without considering the capacity situation, thereby creating the same negative spiral as mentioned at stage 1.

In **stage 3** formal S&OP meetings are being held with top managers of the different departments. The different departments are also having pre-meetings prior to the formal S&OP meeting as to prepare as mentioned in section 3.1.4. The focus of the formal S&OP meeting is on the S&OP integration and addressing unresolved conflicts. Data from key- Suppliers and customers may also begin to influence the meetings at this stage. Stage 3 companies will have regular scheduled meetings most likely monthly, but can be more frequently, they will however be unlikely to meet between the scheduled meetings for any extensive discussions.

Stage 4 extents on the aspects of stage 3, which for the meetings entails that the collaboration extents to external partners as well, in the sense that the top customers and suppliers actively participates, either physically or over conference call or the like. As for stage 3 only having the data of top customers and suppliers be part of the process, at stage 4 the data will be included from a broader set of customers and suppliers. This is for example done by involving them in the S&OP discussions, sometime even require their involvement. The meeting frequency is the same as in stage 3.

Stage 5 will have all the processes of stage 4 and add the meetings that are event driven. This means that they will be able to address issues that can affect planning immediately instead of waiting to the next scheduled meeting. Another important part is that internal personnel and supply partners have access to real time internal and external data. The access of real time data will give the S&OP team early warning signals, and thereby take impeding actions to prevent problems from occurring.

3.2.2 Organization

The organization focuses on the structure of the corporate S&OP see section 3.1.3.4.

At **stage 1** a company does not have any S&OP structure. There is not a S&OP team and there is not a hidden S&OP team with other job descriptions.

At **stage 2** there still is no formal S&OP function, but some of the tasks are being handled by other functions. This will often be some in the top management, who tries to drive sales and operations, through financial goals.

In **stage 3** the S&OP team may be formalized but is not a given. The responsibility of the S&OP functions is placed at another position, such as a product manager or supply chain manager.

Stage 4 will have a formal S&OP team that has executive level participation. The team members of the S&OP team have clearly defined S&OP responsibilities as part of their job description.

At **stage 5** the organization has a formal S&OP with executive level participation like at stage 4. In addition, the understanding of S&OP has spread to the rest of the company. This means that there is an overall understanding that the planning created by the S&OP team is in place for a more profitable outcome, even though it might not be visible on the floor at all times.

3.2.3 Measurements

As mentioned earlier in section 3.1.4 S&OP measurements form the basis for implementation and continuous improvement.

At **stage 1** there are no measurement specific to measuring S&OP. This often means that the only measurements available are based on standard financial measurements. This makes it difficult to make planning based on past performances.

In **stage 2** operations are measured on how well they can meet the sales plan. This way of measuring means that only operations are held accountable, and it is their department that will need to adjust their plans if the sales plan does not hold up. This can often lead to inflated sales forecasts, since sales are not held accountable.

At **stage 3** operations are measured as in stage 2, but also sales are now measured on how accurate their sales forecast is.

At **Stage 4** two new aspects are added to stage 3, new product introduction and S&OP effectiveness. New product introduction is added, because it is harder to measure the performances of a product without a demand history, which then will require a more mature organization to be able to measure new products. When a company is at stage 4, they are intentional about measuring their effectiveness and efficiency. Here measures include development cost, time to market, ramp-up time, and the number of successful introductions. Furthermore, it is recommended that there is an evaluation of each S&OP team member from their peers, supervisors, and subordinates. This is especially important regarding their participation in the S&OP process. Additionally, suppliers and customers should be asked for feedback on especially the process, as to help provide continuous improvement.

At **stage 5** one last aspect is added to what is obtained until stage 4, and that is company profitability. Profitability is already a measurement within a company, but when a S&OP team reaches this stage, it should be able to measure the profitability in link to the S&OP process. This will mean that sales and operations are not just accountable for forecasts and meeting sales plans, but also for adjusting prices and adjusting inventories and production plans. There is not a single framework in the red literature that can function as a model for the organizations to use, so this will also be a challenge to a team that reaches this stage.

3.2.4 Information Technology

Information technology is an information process, which means that it is the process that information is stored. This is a point where (Grimson & Pyke 2007) is out of date, not in terms of the maturity model itself, but the possibilities of the software available. (Danese et al. 2017) have built their article on the model from (Grimson & Pyke 2007) and will therefore be the supporting reference in this section.

At **stage 1** the information is stored on a few spreadsheets, owned, and updated by the individual managers and not shared or consolidated.

At **stage 2** the information is still on individual spreadsheet, owned and updated by individual managers, but at this point there will be some manual consolidation.

Stage 3 companies will have centralized the information in an automated system through a revenue or operations planning software.

At **stage 4** the companies have a revenue and operations optimization software but optimizes the plans sequentially or separately instead of jointly. As for revenue optimization the software analyzes past data to set an optimal prize, while operations optimization software can analyze multiple production sequences to find the optimal sequence of production to fulfill the desired performance objective. Furthermore, firms at this stage employ a S&OP workbench. A Workbench is an automated tool which is accessible throughout the organization and shares information about sales and operations plans among the team members. Due to the size and complexity of the solutions most of these processes are done on a batch basis.

At **stage 5** the technology is real time data available throughout the supply chain making it possible to react immediately to market changes. The technology will furthermore be able to make automated problem solving based on the data it collects.

3.2.5 S&OP Plan Integration

S&OP plan integration is the measurement of how effectively the sales and operations plan are build and how well the plans interface. In other words, this will give an indication of the collective look of the four first dimensions.

At **stage 1** with no S&OP planning and lack of sales forecast, companies at this stage will attempt to meet incoming orders without any advanced info.

At **stage 2** the sales plan is the main driving force and the operations plan will need to adjust accordingly. This means that capacity utilization techniques and operations expertise are not fully utilized. A top-down approach will dominate at this stage.

A **stage 3** organization will still have a sequential focus that means the sales plan is used to drive the operations plan. However, operational plans and expertise are now being heard, and sales plan can therefore be adjusted when need be to support the operations plan. Moreover, forecasts are now created as a bottom-up approach, with a sequential adjustment in collaboration with operational and financial goals, in order to make a more integrated and realistic plan.

At **stage 4** the companies will develop the plans in full collaboration instead of being driven from sales. This will also mean that the planning is now concurrent and not sequential.

An organization at **stage 5** operates seamlessly concurrent for demand and supply. This will maximize sales revenue, operational efficiency, and profitability. At this stage all team members are heard and responded to. The main goal is profit optimization and all constraints have been considered in order to achieve this from every aspect.

3.3 Key Findings from literature review

As to discuss and answer the research questions, the key findings of the literature review will be summarized and processed in this section. To be able to assess a current S&OP situation, the literature has been reviewed on what S&OP entails, how it is build, and what stages of maturity the S&OP process can go through.

Assessing through a maturity model can have the benefit of a good overview of where the current situation is, and where it needs to evolve for the company to improve its S&OP. Therefore, the maturity model from section 3.2 has been taken as a base used to implement some of the key findings from section 3.1 into a new maturity model. The new maturity model will maintain the same five maturity stages but will change the dimensions. The new dimensions are:

1. People
2. Organization
3. Process & Integration
4. Information Technology
5. Strategic Alignment & Performance Management

The following sections will outline what these new dimensions will entail and how they will mature throughout the five stages. The new maturity model will be displayed in Figure 14 after the chapter summary in section 3.4.

3.3.1 People

This Dimension is a rewritten version of (Grimson & Pyke 2007)'s dimension "meetings & collaboration" see section 3.2.1. The "meeting" part has been taken out and will be moved to "process & integration" see section 3.3.3. By rewriting this dimension to be about people, the dimension will focus on the collaboration part of 3.2.1 combined with the intraorganizational collaborations from section 3.1.2.5 and interorganizational collaborations from section 3.1.2.6. Furthermore, the dimension will also include the people aspect of the cultural and socialization aspects of section 3.1.2.8 and section 3.1.3.5.

The following will place these aspects into the five maturity stages:
Stage 1 will neither have collaboration internally between departments nor will it collaborate with external suppliers or customers. No collaborating will create a silo culture, where departments even might work against each other, both involuntarily or competitively. There is no top management encouragement to work across departments.

At **stage 2** the top management starts to collaborate and hold meetings, and there will therefore be a link between demand and operations, but there will still not be well defined responsibilities below the top management. This top down approach will keep the silo culture alive under the top management level.

At **stage 3** The roles and responsibilities have been defined, and the departments will start to have a planning and collaborative culture. The departments will have pre-meetings to plan for the S&OP meetings. Collaboration will also extend to using top supplier and top customer data at planning meetings.

Stage 4 will see highly socialized culture, where collaboration is part of the daily work process, and teams are formed cross departmental. There will be a higher degree of using data from suppliers and customers, and the top suppliers and customers will be invited to participate at the formal S&OP meetings.

At **stage 5** the employees will find themselves taking on more responsibility and all employees find themselves taking ownership of their part of the process, and therefore facilitating part of the formal S&OP meetings. There will be a proactive culture, where employees can help prevent emerging problem at other departments.

3.3.2 Organization

The organization dimension is almost unchanged from the one in section 3.2.2 by (Grimson & Pyke 2007). To analyze the maturity of the organization when taking about S&OP is firstly to establish the actual recognition of the need for a formal S&OP structure. This will be visible in the formality of the team working with S&OP. A formal S&OP team is a team with clear S&OP responsibilities within their job description, this is sometimes overlooked, by creating teams where the members have their responsibilities to their respective departments and therefore will be accountable in the department and not for the result of the collective S&OP. Furthermore, the role of the top management needs to be assessed. A lack of top management prioritization will mean a lack of employee participation, whereas top management involvement can be done in a couple of ways. It can be top management S&OP, which means that the employees are trusted to prepare the top management, but the top management will hold the S&OP meeting and decide, before dictating to their departments what the decisions are. It can be formal S&OP meetings for the top management with employee participation, which will see the employees participating, but it will still be driven by top management and S&OP champions. Lastly it can be formal S&OP meetings with top management participation. This will mean that the top management are participating to give help, insights, and most importantly empowerment and a decision-making mandate to the formal S&OP team who will take ownership and be accountable for their own parts of the S&OP.

3.3.3 Process & Integration

This dimension is a fusion between the meeting part of (Grimson & Pyke 2007)'s "meeting & collaboration" dimension as described in section 3.2.1 and the "S&OP plan integration" which is described in section 3.2.5. As part of this new dimension processes will be looked at with use of section 3.1.2.2 for formalization and standardization and section 3.1.3.2 for a general understanding of S&OP processes

At **stage 1** there are no S&OP process and therefore no S&OP meetings.

At **stage 2** there are top management S&OP meetings, they are not necessarily on a regular schedule. At this stage there might be pre-meetings in departments to prepare top management for their S&OP meeting. The process will be dictated with a top down approach as described in the previous section 3.3.2.

In **stage 3** the process will have been formalized and structured, resulting in regular formal S&OP meeting. These will have pre-meetings to prepare the employees that will join the formal meeting. Employees will influence the process but might be overruled due to business goals.

Stage 4 might see the formal S&OP meetings be on a more frequently but still regularly basis. The process goes from being sequential to being more concurrent and collaborative. The process can be balanced with suppliers and customers, as to optimize the collaborative process.

At **stage 5** the meetings will add an extra layer of being event driven, which means that in addition to the regular scheduled meeting, the S&OP team will meet in between meetings, when a situation occurs, or even and more optimally, a possible situation occurs, which will help the team either deal with a situation immediately and even prevent the situation to occur.

3.3.4 Information technology

This dimension is unchanged from the dimension described in section 3.2.4 based on the dimension "information technology" by (Grimson & Pyke 2007) and the dimension "information technology" by (Danese et al. 2017). This dimension is about how the company stores, consolidates, and shares data. Since cross-functional work is very important within a S&OP driven company, it is important that the technology supports this. During the first two stages the need for advanced and complex software is not present, and simple spreadsheets can suffice. Consolidation does not happen on **stage 1** but at **stage 2** it will be done manually. Sharing of the spreadsheets will be done manually, or at stage 2 with functional solutions, like a shared drive. The first level of complexed systems will appear at **stage 3** and will provide a centralized access to the data. The software will also be able to provide planning assistance by calculating forecasts based on historical data and help with capacity planning. During **stage 4** the complexity increases, and the software can help the decision making by planning for different scenarios and calculate optimal prices and optimal production sequences. At **stage 5** the software will include external partners as suppliers and customers and provide real time data. This will provide the ability to continuously improve on the planning and prevent stock out and overproduction. This kind of software also have the possibilities to make automated order systems in collaboration with suppliers and customers.

3.3.5 Strategic Alignment & Performance Management

This dimension is a rewritten version of (Grimson & Pyke 2007)'s "measurements" dimension described in section 3.2.3. This dimension will also tap into the knowledge about performance management described in section 3.1.3.6, behavior control through measurements as described in section 3.1.2.4 and lastly it will include strategic alignment described in section 3.1.3.1.

Strategic alignment and performance management are on each end of the actual S&OP process as seen in Figure 12. Strategic alignment is the balance between long term strategy and the short-term tactics. A way to ensure this balance is as desired can be through performance management. Performance management is founded in the choice of critical success factors, in more precise term, it is controlled by the measures, that a company chooses to evaluate performance on.

At **stage 1** there are no alignment between strategy and tactical plans. Mostly it will be due to lack of tactical plans as there are no planning function. There will be no measurements used to control behavior and steer the company in a certain direction.

In **stage 2** the financial goals are driving the behavior, which then means that the behavior will be to measure how well operations is responding to a sales plan. This will mean that the alignment between the tactical plans are only made with the business strategy in mind and neglecting the production strategy. Thereby creating a behavior that are an out of balance responsibility and accountability.

At **stage 3** there will be added a strategic alignment with the production strategy and performance measures will now include sales forecast accuracy. Thereby holding both sales and operations accountable for their performances. The goals will be a tradeoff between sales and production measures, creating a collaborating behavior.

At **stage 4** strategic alignment will start to form externally with top suppliers and customers. Performance measures to manage new product introduction and S&OP effectiveness will be added to the critical success factors. An individual evaluation of the S&OP team members by their peers is recommended as part of measuring the effectiveness.

At **stage 5** a company will be fully aligned internally and with main suppliers and customers. Measurements based on the S&OP team's impact on the company's profitability.

3.4 Chapter Summary

This chapter is the baseline for the rest of the study as it will be used to assess the S&OP process at Daltile and will help determine what they need to do if they want to improve their S&OP maturity.

	Stage 1 No S&OP Process	**Stage 2** Reactive	**Stage 3** Standard	**Stage 4** Advanced	**Stage 5** Proactive
People	• No collaboration • Silo Culture • No top management encouragement	• Top management collaboration • Silo culture below top management	• Defined roles & responsibility • Emerging collaborate culture • Some supplier & customer data	• Highly socialized culture • Cross-departmental teams • More data from suppliers & customers • Top suppliers and customers invited to meetings	• Employees take ownership of S&OP • Employees facilitate at meetings • Cross-functional responsibility • Expanded external collaboration with suppliers and customers
Organization	• No S&OP function • No formal S&OP responsibility	• S&OP functions managed by top management • Departments might be used to prepare top management • Top-down responsibility	• Pre-meetings in departments • S&OP team responsible to departments • S&OP meeting with employee participation	• Formal S&OP team • S&OP meeting with top management participation • More employee responsibility	• S&OP team takes ownership • Decision making mandate by top management • Full company understanding of the S&OP team's role
Process & Integration	• No S&OP process • No S&OP meetings	• Top management meetings • Might have pre-meetings in departments • Top-down process	• Regular formal S&OP meetings • Pre-meetings in departments • Bottom-up but might be overruled by goals	• Meetings might be made more frequently • Concurrent & collaborate process • Process balanced with suppliers and customers	• Event driven meetings in addition to regularly scheduled • Dynamic process
Information Technology	• Individual managers keep own spreadsheets • No consolidation of information	• Many spreadsheets or functional solutions • Little consolidation done manually	• Integrated demand and supply planning software • Centralized access for S&OP team	• Revenue and optimization software used sequentially instead of jointly • Software can help set optimal prizes and optimal sequence of production based on available data • Scenario planning	• Access to supplier and customer data • Possibility to automate supplier and customer order • Real time data
Strategic Alignment & Performance Management	• No alignment • No measurements	• Alignment only with business strategy • Measures how operations meet sales plan	• Alignment with both business and production strategy • Sales forecast accuracy is measured • Goals are tradeoffs between sales and operations performances	• Alignment might extend to external partners • New product introduction • S&OP effectiveness • Individual evaluation of team members	• Full alignment internally and with top suppliers and customers • S&OP team will be assessed on their impact to company profitability

Figure 14 - New maturity model framework

4.0 Data Analysis

This section will analyze the current S&OP execution at Daltile based on the data gathered throughout this project. This analysis will be compared with the literature review as to make the basis of the gap analysis in chapter five, see Figure 15.

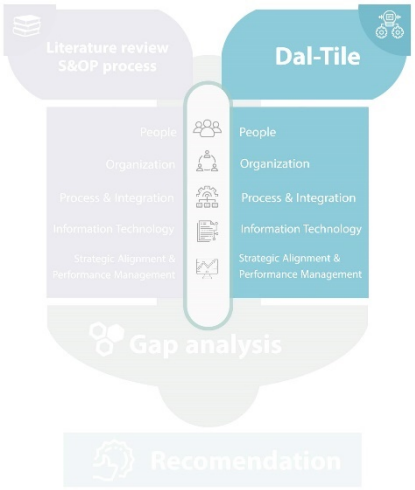

Figure 15 – Project framework Dal-Tile analysis

The data has been gathered through two data collection methods. The first is through personal semi structured interviews at Daltile, and the second is through follow up questions send by e-mail to the relevant personnel.

The first interview was set up with an interview guide based on the general knowledge obtained through the literature review and where therefore more generic as to determine the angle to approach the assessment, see appendix A. The follow up interview was then conducted with the angle based directly from the key takeaways from the literature review, as it was determined to best angle to create the assessment and further on to make the GAP analysis, see appendix B.

The data analysis itself will be crafted as a walkthrough of the current S&OP execution as to introduce the data collected in the setting of the S&OP process. This will be followed by an assessment of the five dimensions of section the literature review has determined to be the key to assess S&OP in section 3.3. The five dimensions will be analysis in individual sections within the framework of section 3.3. The five dimensions are “People”, “Organization”, “Process & Integration”, “Information Technology”, and “Strategic Alignment & Performance Management”.

4.1 Current S&OP execution

This section will describe current situation and execution of S&OP at Daltile based on the interviews see appendix C.

Daltile have a formal cross-functional S&OP team and monthly formal S&OP meetings with manager attendance from sales, finance, and logistic and top management attendance from sales, finance, logistics, manufacturing, human resources, and the company president. The sales department and the logistic department have been situated next to each other as to encourage collaboration and easy access to information and knowledge sharing when needed. The five step S&OP execution process described in

section 3.1.4 almost fluctuates with how Daltile's S&OP execution is processed, but at Daltile there is an extra step between the pre-meetings, step 1 and 2, and the formal meeting, step 3, see appendix C.

The S&OP process starts with **step 1** the sales department having a pre-meeting one week before the monthly formal S&OP meetings, where the sales forecast is created. The forecast is created as a monthly and a weekly forecast. After the sales forecast is created, the logistic team will have a pre-meeting of their own, **step 2**, where their task is to create the production plan for the next period as to meet the sales forecast. After preparing sales and production plan, the respective department directors present the plans for top management, **step 3**, with "the purpose of ensuring alignment and top management approval"[2]. After these three pre-meetings have been handled and agreed upon, the formal S&OP meeting takes place, **step 4**. This meeting has the managers and directors participating and there is a general consensus from both managers and top management that the level of participation is high, and the logistic director notes that everybody takes accountability for what they provide to the meetings, see appendix C. These meeting are facilitated by the planning superintendent, from the logistic department. The planning superintendent is qualified due to her planning expertise and are considered Daltile's S&OP champion. The role of the top management during the meetings are to evaluate the results of the meeting, push for improvement suggestion, and in the end, approve the team's suggestions. The meetings are a clearly top-down process, which is recognized by both the managers and the top management. Implementing, maintaining, adjusting the plans, **step 5**, are the sole responsibility of the logistic department to ensure the operating plan is executed. This is also evident in how the KPI's for S&OP have been constructed, **step 6**, as the measurements of success used are inventory turns, inventory level, service level (product availability), and backorder. These are all measurements of operational performance. Which indicates a strategic alignment with sales forecast as the main driving force, and operations secondary. This means that Daltile continuously adjust production to non-forecasted demand, see Table 8.

Step	Description	Involved department	Involved personnel	Purpose	Outcome
1	Pre-meeting	Sales	• Sales personal • sales director	Create demand forecast	Preliminary demand forecast
2	Pre-meeting	Logistic	• Planners • logistics director	Create production plan	Preliminary production plan
3	Pre-meeting	All departments	• Department directors • company president	Approve step 1 and 2	approved demand forecast and production plan
4	Formal S&OP meeting	• Sales • Finance • Logistic	• Sales managers • Finance managers • Logistic managers	Create a single operating plan for the next period	A single operations plan

[2] Quote Karla Perez from the second round follow up mail appendix C

		• Manufacturing • HR	• Directors from all departments • Company president		for the upcoming period
5	Implementation of plan	Logistics	• Planners • superintendent	Implementing the operations plan	Operational performance
6	Performance measurements	Logistics	• Inventory turns • Inventory level • Service level • Backorder	• Behavioral control • Measuring performance	Operations measured on how they meet the sales plan

Table 8 – S&OP execution at Daltile

4.2 People

At Daltile there have been made a conscious decision to enhance the collaborative culture needed for the S&OP process. One outcome has been to nourish the collaboration between the sales and logistics departments by physically placing their offices next to each with glass walls and doors to break down the barriers. This facilitates communication between relevant parties. This does not however include the top management, who are located in another building. Both aspects were observed by the interviewer when going to conduct the interviews. There is an informal tone between the employees below the top management, which contributes to a more collaborative culture. Although the teams are collaborative and there is a focus on nurturing this from a leadership perspective, it is still emerging, and the individual focus of responsibility still belongs to their own department firstly, and secondly to the S&OP collaboration.

According to the framework's people dimension these findings indicate that Daltile is at an early maturity stage three. The collaborative culture is present, but still in its emerging phase. There is clear roles and responsibility, however this is not defined to the S&OP team but by the employee's own departments. There is a clear lack of collaboration with suppliers and customers in the S&OP execution, which means no inclusion of supplier and customer data into the S&OP process. see Figure 16.

	Stage 1 **No S&OP Process**	Stage 2 **Reactive**	Stage 3 **Standard**	Stage 4 **Advanced**	Stage 5 **Proactive**
People	• No collaboration • Silo Culture • No top management encouragement	• Top management collaboration • Silo culture below top management	• Defined roles & responsibility ✓ • Emerging collaborate culture ✓ • Some supplier & customer data ✗	• Highly socialized culture • Cross-departmental teams • More data from suppliers & customers • Top suppliers and customers invited to meetings	• Employees take ownership of S&OP • Employees facilitate at meetings • Cross-functional responsibility • Expanded external collaboration with suppliers and customers

Figure 16 - people dimension of the maturity framework

4.3 Organization

The interviews indicated that a formal S&OP structure is being build, meaning that the first step of recognizing the need for a formal S&OP structure has been identified, see section see section 3.3.2. There is a formal S&OP team with clear S&OP champions and clear top management support. The S&OP team have formal meetings and pre-meetings, which are indicators of a defined S&OP structure. However, there are also signs that indicates that the process is still under development. Most members of the S&OP team are only accountable for their departmental commitment and not their contribution to the S&OP process. The research showed that only a planner and the planning superintendent from the logistic department were accountable for their S&OP contribution. The superintendent is considered the S&OP champion. The analysis found no empowerment of the S&OP team by top management, making them formal decisionmakers. Instead the S&OP team makes suggestions that top management base their decisions on. Top management do encourage participation in the S&OP process and there was found consensus indicating high participation rate in the meetings. The knowledge of the S&OP structure and its role in company planning is growing, but still in its early stages, see appendix C.

Considering the findings Daltile's S&OP organizational maturity is at stage three even though the top-down approach to responsibility of decision making belongs to stage two, see Figure 17. Addressing this is essential to improve Daltile's S&OP maturity.

	Stage 1 **No S&OP Process**	Stage 2 **Reactive**	Stage 3 **Standard**	Stage 4 **Advanced**	Stage 5 **Proactive**
Organization	• No S&OP function • No formal S&OP responsibility	• S&OP functions managed by top management • Departments might be used to prepare top management • Top-down responsibility ✓	• Pre-meetings in departments ✓ • S&OP team responsible to departments ✓ • S&OP meeting with employee participation ✓	• Formal S&OP team ✓ • S&OP meeting with top management participation • More employee responsibility	• S&OP team takes ownership • Decision making mandate by top management • Full company understanding of the S&OP team's role

Figure 17 - Organization dimension of the maturity framework

4.4 Process & Integration

Daltile conducts formal S&OP meetings with the managers and top management directors as described in section 4.1. Additionally, the sales and logistics departments have pre-meetings to prepare the sales forecast and production plan. These plans are then approved at a top management pre-meeting prior to the formal S&OP meeting. The formal S&OP meeting is conducted as a top-down process, with the sales forecast and financial goals as the driving force.

The findings places Daltile's process & integration at maturity stage three. However, the top-down process that is executed at Daltile is still a reactive approach and is therefore a point in the process where Daltile's maturity resembles stage two, see Figure 18.

	Stage 1 **No S&OP Process**	Stage 2 **Reactive**	Stage 3 **Standard**	Stage 4 **Advanced**	Stage 5 **Proactive**
Process & Integration	• No S&OP process • No S&OP meetings	• Top management meetings • Might have pre-meetings in departments • Top-down process ✓	• Regular formal S&OP meetings ✓ • Pre-meetings in departments ✓ • Bottom-up but might be overruled by goals ✗	• Meetings might be made more frequently • Concurrent & collaborate process • Process balanced with suppliers and customers	• Event driven meetings in addition to regularly scheduled • Dynamic process

Figure 18 - Process & Integration dimension of the maturity framework

4.5 Information Technology

When it comes to the infrastructure of the information technology, Daltile is limited to using Microsoft Excel for S&OP. Daltile have made no greater investments to this part of the infrastructure. The interviews revealed that Excel spreadsheets are created individually, and then shared and consolidated manually. There are shared drives that functions to centralize data and to increase availability. At the interview the planning superintendent noted that she wished for some software that could help improve forecasting, or at least do some scenario planning to prepare them for different outcomes, see appendix C.

The use of individual spreadsheets, with manual sharing and consolidation, places the maturity level of the S&OP information technology dimension on a maturity level of two, see Figure 19.

	Stage 1 **No S&OP Process**	Stage 2 **Reactive**	Stage 3 **Standard**	Stage 4 **Advanced**	Stage 5 **Proactive**
Information Technology	• Individual managers keep own spreadsheets • No consolidation of information	• Many spreadsheets or functional solutions ✓ • Little consolidation done manually ✓	• Integrated demand and supply planning software • Centralized access for S&OP team	• Revenue and optimization software used sequentially instead of jointly • Software can help set optimal prizes and optimal sequence of production based on available data • Scenario planning	• Access to supplier and customer data • Possibility to automate supplier and customer order • Real time data

Figure 19 - Information Technology dimension of the maturity framework

4.6 Strategic Alignment & Performance Management

Daltile uses inventory turns, inventory level, service level, and backorder as their critical success factors. But interestingly inventory turns, and service level was mentioned by all, while inventory level and backorder were only mentioned by the director, which can indicate there is a need for clear communication, see appendix C. This means that the performance is measured on reactive indicators that clearly indicate that operations are measured on how it meets the sales plan. These success factors clearly confirm that the sole driver of the S&OP is the sales forecast. Which then means that to create success when it does not go according to the plans, it will be up to operations to adjust accordingly. Since there are no measurements used to measure the success of the demand forecast, the sales department are not held responsible, creating an imbalance in the strategic alignment. This can, as mentioned in section 3.1.3.6, create a negative spiral between the production plan and the sales forecasts. It was also mentioned in the primary interview that the forecasts are often inaccurate see appendix C.

As to the maturity level of Daltile within the strategic alignment & performance management, the company is at maturity level two, Figure 20. Daltile have an imbalanced strategic alignment, that only aligns with the business strategy. Furthermore, stage two is also relevant for only using critical success factors that measures how operations meet the sales plan.

	Stage 1 **No S&OP Process**	Stage 2 **Reactive**	Stage 3 **Standard**	Stage 4 **Advanced**	Stage 5 **Proactive**
Strategic Alignment & Performance Management	• No alignment • No measurements	• Alignment only with business strategy ✓ • Measures how operations meet sales plan ✓	• Alignment with both business and production strategy • Sales forecast accuracy is measured • Goals are tradeoffs between sales and operations performances	• Alignment might extend to external partners • New product introduction • S&OP effectiveness • Individual evaluation of team members	• Full alignment internally and with top suppliers and customers • S&OP team will be assessed on their impact to company profitability

Figure 20 - The strategic alignment & performance management dimension of the maturity framework

4.7 Chapter Summary

Through the data processed it becomes clear that Daltile has established S&OP, but it is still in the reactive stage two. A simple average of the stages of the five dimensions will position Daltile at a 2.6 maturity level. Even though it is not always as simple as taken an average, since the dimensions are assessed individually, a score of 2.6 sums up the level of Daltile's S&OP quite accurate. Daltile will on the basis of the score be classified as having a reactive S&OP process, but well on the way into a standard S&OP process.

The company are well into stage three when it comes to the people dimension in terms of having a collaborative culture and defined roles. The organizational dimension and the process & integration dimension is also situated at maturity stage three. These three dimension indicates that Daltile has a good understanding of the importance of having a good S&OP infrastructure and knows the importance of having the correct cultural mindset. These three dimensions are all business dimensions, which indicates that it is the business part of S&OP that Daltile has developed most. The information process dimensions alongside the performance management dimension, are all heavily situated at stage two.

The next chapter will analyze and determine what Daltile will need to do in order to increase their S&OP maturity level, as to advance from the reactive stage that currently dominate their S&OP structure.

5.0 Gap Analysis

This chapter will analyze the gap between the current assessment of Daltile and what the literature review has showed as the optimal S&OP maturity, see Figure 21. The gaps will be analyzed individually for each of the five maturity dimensions and presented in the maturity model from section 3.3. The gap analysis of each dimension will firstly determine the gaps to close the current maturity level identified in chapter 4.0. Next, are the initiatives and actions needed to reach next maturity stage. After individual analyses of the maturity dimensions a collective prioritization of the recommended initiatives are presented including cost-benefit analysis. The outcome of this chapter will be a recommended 3 phase process to implement the solutions. This will be the basis of the project discussion in the next chapter.

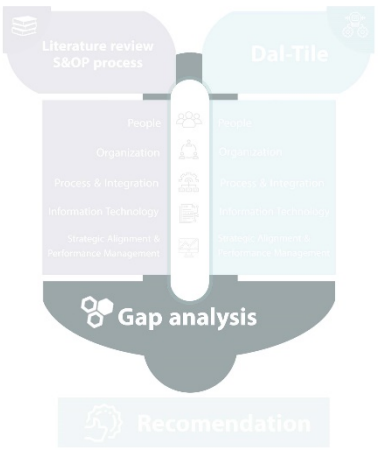

Figure 21 – Project framework gap analysis

5.1 People

The data analysis in section 4.2 determined that this dimension was an early stage three. The analysis based this on Daltile having a conscious determination to create a collaborate culture and that they were already defining roles and responsibilities. For this dimension there will be three levels of recommendations. The first step is to consolidate maturity stage three, the next is defining the journey to reach maturity stage four, and lastly how to reach maturity stage five.

5.1.1 Consolidating Maturity Stage Three

The gaps found to fully consolidate their current maturity of stage three are:

1. Strengthen the collaborative culture
2. Move responsibility to the collaborative S&OP team instead of individual departments
3. Improve external collaboration in the planning phase

5.1.1.1 Strengthen the collaborative culture

The collaborative culture of the S&OP team needs to continue their journey to be strengthened further. As stated in section 4.2 top management has physically moved sales and production together to improve internal collaboration. To strengthen or otherwise affect a culture, it is necessary to realize the need for mental and behavioral change, and this process requires time and training. Amongst the initiatives Daltile should consider are; creating common team building exercises, emphasize collaboration as the way forward from top management, making the need to collaborate visible in the day to day work life.

Moreover, the top management could consider making them collaborate on tasks that are usually reserved for one specific department. This will help understand what each other are doing and see what their backgrounds can give each other. These initiatives could strengthen the collaborative mentality between departments and are considered part of a continuous improvement effort that is part of all the upcoming stages.

5.1.1.2 Move responsibility to the collaborative S&OP team instead of individual departments

The people who are part of the S&OP team, needs clearly defined responsibilities, and it is imperative that the departmental responsibility, does not contradict the responsibility to the S&OP team. This can be solved by top management ensuring that the S&OP team members does not compete against each other on the basis of their departments, but that the tradeoffs made within the formal S&OP meetings are seen as the goals for each department. They way to implement this kind of mentality, comes through training and empowerment. It is important that everyone working within S&OP understands the importance of the collaborate work and the S&OP team. The team's decisions need to get the correct empowerment as to take priority for all the relevant departments.

5.1.1.3 Improve external collaboration in the planning phase

Currently Daltile do not use data input from the external collaborators to assist in the formal S&OP meetings. Using these data inputs could help creating a more precise and flexible operations plan. As mentioned in the literature review; top customer and supplier data should be involved at maturity stage three to improve the planning result. The procurement responsible needs to recognize who the top suppliers are and initiate a formal collaboration to obtain the necessary data input for the planning phase. To ensure collaboration with customers, the responsible of the sales department needs to do the same. These datasets will provide as input to the formal S&OP meeting, where the team can use the data to optimize the planning.

5.1.2 Moving from maturity stage three to maturity stage four

Successful implementation of all initiatives at maturity stage three is essential to move on to maturity stage four. Maturity stage four is as the framework indicates an advanced function of maturity stage three, whereas the initiatives needed to reach this maturity stage is an improvement of the stage three initiatives.

The gaps between stage three and stage four for the people dimension are:

1. Having cross-departmental teams
2. Expanded datasets from external collaborators
3. Top external collaborators participate in formal S&OP meetings

5.1.2.1 Establishing cross-departmental teams

Up until this stage, the only cross-functional team has been the S&OP team. At this stage to further exploit the collaborative culture cultivated through stage three, it is recommended to create more cross-functional teams and work units. These can be for continuously assignments and for temporarily project work. These teams will help create a unison and coherent atmosphere between the departments. In addition to the continuous collaboration initiatives from stage three, it will also help cultivate a highly socialized culture across departments and functions.

5.1.2.2 Expand datasets from external collaborators

At stage three, data from top suppliers and customers where included to optimize the planning. When reaching stage four the company is ready to expand on that dataset by including more data from more suppliers and customers. Optimally all suppliers and customers are included, but this is rarely feasible in practice since some suppliers or customers are so insignificant a part of the business (works both ways), that it will not be worth the effort. Furthermore, it is not always in the external collaborators interest or ability to share the data in question.

5.1.2.3 Invite important external collaborators to participate in the S&OP process

An aspect of maturity stage four, is to include external collaborators more directly in the S&OP process. This could extent the collaboration to a more wholesome partnership and create a leeway for a symbiotic approach, benefitting both Daltile and the partner. First step of implementation is to invite top suppliers and customers to participate in a closer collaboration. When these partnerships are functioning at a satisfactory level more customers and suppliers can be added to the scope.

5.1.3 Moving from maturity stage four to maturity stage five

As maturity stage four is accomplished, the company should aim at stage five. As mentioned in section 3.2 there are no examples in literature of a company successfully reaching a full stage five, despite having some of the attributes. Maturity stage five attributes are continuous improvements reaching a certain development of maturity stage four attributes.

The gaps between stage four and stage five are:

1. Employees take full ownership of the S&OP process
2. Employees take cross-functionally responsibility
3. Data from external collaborations are real-time and automated

5.1.3.1 Employees take full ownership of the S&OP process

The continuous improvement, training of employees and the culture that have been applied through maturity stage three and four, will at this point make the employees ready to take full ownership of the process. The role for top management, is to empower the S&OP team in their decision-making. When employees take ownership, it will be natural for each team member to be able to facilitate meetings and be fully responsible for their part of the process. The action needed to be taken by the top management is a step back and allow the employees to take full responsibility of the process.

5.1.3.2 Employees take cross-functions responsibility

This gap is a natural extension of the continuous improvement and training of employees and culture. Especially the making of cross functional teams will see employees taking responsibility across departments. The change needed is for top management to recognize that employees are ready to handle the responsibility and empower them to do so.

5.1.3.3 Data from external collaborations becomes real-time and automated

Collaboration with suppliers and customers is ready to evolve into a full partnerships and automated real-time data shared between the entities. This will make procurement and sales able to always be aware of the current situations and gives the ability to encounter issues before they are problems. In order to accomplish this, the information technology will also have to be at maturity level five.

5.2 Organization

The data analysis in section 4.3 determined that this dimension is at a consolidated maturity stage three. The data analysis based this on the Daltile having a S&OP team whom where still responsible to their departments, pre-meetings prior to formal S&OP meetings, and that the formal S&OP meetings are run and decided by top management. Since maturity stage three is consolidated, the first initiatives for this stage will be to determine what is needed to reach maturity stage four. Furthermore, there will be laid a path to move to maturity stage five.

5.2.1 How to reach maturity stage four

The gaps found in order to reach maturity stage four are:

1. The formal S&OP team responsibilities must be clearly defined
2. The employees need to take on more responsibility
3. The formal S&OP meetings need to be bottom-up driven

5.2.1.1 The formal S&OP responsibilities must be clearly defined

The formal S&OP team must have their roles as S&OP team supersede their roles in their original departments. By doing so, S&OP team members can focus on the cross-functional goals of the S&OP instead of focusing on pursuing departmental objectives. To ensure this, top management must ensure training and clearly support the S&OP team and its members to make this mindset shift.

5.2.1.2 More employee responsibility

The employees need to take more responsibility and in order to do so there has to be an empowerment from the top management. This empowerment will have to come from the top management as a clear statement to the employees. The S&OP team do not need to get approval for all decisions made. The role of top management will be a more supervising role and keeping the big picture.

5.2.1.3 Making the formal S&OP meetings bottom-up driven

The formal S&OP meetings needs to be driven, facilitated, and dominated by the S&OP team, and they need to have the authority to make decisions. Top management should participate as to give the meeting legitimacy, give advice, encourage participants, and empower the decision making.

5.2.2 Moving from maturity stage four to maturity stage five

As maturity stage four is accomplished, the organization will be ready to start moving towards maturity stage five. Maturity stage five is a further development of maturity stage four attributes. The gaps found to reach maturity level five are:

1. The formal S&OP team ownership must be clearly defined
2. Full mandate to the S&OP team
3. Organizational understanding of the S&OP approach

5.2.2.1 The formal S&OP ownership must be clearly defined

In continuance of section 5.2.1.1, the mindset and training of the S&OP team is fully focused on the S&OP process. Next step for the S&OP team is to take full ownership of the process and decision-making control. Top management's function is to supervise and gives advice when needed. This initiative is concretely a top management task to entrust the employees to take ownership of the S&OP process.

5.2.2.2 Full mandate to the S&OP team

This gap is a continuance of section 5.2.1.2 that expands the mandate given to the employees to be a fully bottom-up decision-making unit. This will require that the top management gives the mandate and can take a step back from the process into a more supervising role.

5.2.2.3 Organizational understanding of the S&OP approach

This step has the purpose of creating a broader understanding of why the S&OP team can dictate and limit individual departmental tasks. Since it is not always obvious in the different department why they should not work to maximize their output, it is up to the S&OP department to make the tradeoff in a larger organizational context. To have optimal conditions for the S&OP team, and not harboring resentment from other departments, it could turn beneficial to invest time and effort in educating the whole company. When S&OP is at this maturity stage, the knowledge of the S&OP effort is probably already known due to the cross-functional teams and work the S&OP team is already a part of. Initiatives to visualize the actual accomplishment of the S&OP team and their contribution to overall company profitability could be a direct way of illustrating the importance of the effort the team is doing.

5.3 Process & Integration

The data analysis in section 4.4 determined that the process and integration dimension is at a transitional stage entering maturity stage three. Besides still operating in a top-down manner, Daltile have accomplished all aspects of the third maturity stage. Meaning that Daltile has successfully achieved the following maturity step three aspects of having regular monthly formal S&OP meetings and before that departmental pre-meetings. Therefore, the first objective is to consolidate maturity stage three. After settling in maturity stage three, Daltile should aim at approaching stage four and later five. How to do so will be presented in the following sub-sections.

5.3.1 Consolidating maturity stage three

The gap found to consolidate maturity stage three for the dimension is:

1. Introducing a bottom-up process

5.3.1.1 Introducing a bottom-up process

Daltile has a top-down process, which was natural at the reactive maturity stage two, but as the S&OP process matures, more of the initiative needs to come from the employees who handles the day to day work. Handing the employees more initiative is also a way to empower employees and ignite a sense of ownership and responsibility.

Daltile might encounter a challenge at this maturity stage as the organization is very goal-oriented and puts little emphasis on the process. Therefore, top management goals might hinder the bottom-up suggestions for successful execution. To effectively introduce a bottom-up approach, top management must slowly loosen the reins and hand tasks and responsibility of conducting and facilitating the formal S&OP meeting to the team in question.

5.3.2 Moving this dimension from maturity stage three to maturity stage four

When maturity stage three is consolidated, the process & integration dimension is ready to move for maturity stage four.

The gaps found between maturity stage three and maturity stage four are:

1. Reevaluate meeting frequency
2. Making the process more concurrent and collaborative
3. Balancing the process with external collaborators

5.3.2.1 Reevaluate meeting frequency

At this stage of maturity, the S&OP team are comfortable with the S&OP process and have enough insights and understanding to determine if one the monthly meetings is sufficient. Meaning that from this stage it is important to discuss and consider if the meeting frequency needs to be increased. This gap is therefore not an initiative that necessarily needs to be implemented, but it needs to be discussed within the S&OP team.

5.3.2.2 Making the process more concurrent and collaborate

Until this stage the process has been a clearly sequential process. With maturity stage four in general being a stage across dimensions where focus is on collaboration and cross-functional team work, it is where the process evolves from being sequential to being concurrent. A way of achieving this is to make cross-functional teams execute the pre-meetings, so the sales forecast and the production plan is created concurrently in a more dynamic process.

5.3.2.3 Balancing the process with external collaborators

Across the dimensions maturity stage four has utilized more collaboration with suppliers and customers, which will benefit the process dimension. This is especially a possible outcome of inviting top suppliers and customers to participate in the S&OP process as suggested in section 5.1.2.3. Including external collaborators in the S&OP process, creates trust, and gives opportunities to align planning to benefit both parties.

5.3.3 Moving from maturity stage four to maturity stage five

As the process & integration matures into level four, significant improvements are occurring in the cross-functionality of the S&OP process, and the comfortability and experience with the process and its formal meetings increases the team capabilities. To move into maturity stage five, the S&OP process has to become more proactive.

The gaps found to reach the proactive maturity level five are:

1. Event driven meetings in addition to regular formal meetings
2. Dynamic processes

5.3.3.1 Event driven meetings in addition to regular formal meetings

When reaching the proactive maturity stage five, it is advisable to have more encounters than only the regularly meetings. Introducing event driven S&OP meeting can be a valuable add on. This type of meetings can be set up immediately when events that might affect the plans comes up. Thereby, Daltile do not need to postpone adjustment until next formal S&OP meeting where the event might have occurred. This also provides the team with increased flexibility and ability to preempt negative situations. To introduce event driven meetings, there should be clear guidelines so that the S&OP team can respond immediately to an event driven summon. In the introductory phase, it is advised to identify which kind of events that qualify for extra meetings. The more experienced the team is, the more comfortable the team members will be to recognize if a meeting can be beneficial.

5.3.3.2 Dynamic processes

Having dynamic processes is continuance of a more concurrent process, which makes the cross-functional teams able to switch between processes and change them continuously as needed. The actual initiative here, is to allow the teams more autonomy to change the processes to fit the situations.

5.4 Information Technology

The data analysis in section 4.5 classified Daltile's maturity level in stage two. The primary reason is that Daltile do not have any noticeable information technology infrastructure and are using simple and local spreadsheet. Therefore, the first step will be to move towards maturity stage three. Information technology maturity is a bit different than the other dimensions and can be divided into two parts. The first part is the two first stages, that are void of a real investment in big and usually expensive software solutions. The last three stages demand some degree of software investment, either by building it or investing in a software. The most accessible solution is to invest in a preexisting software, and for that there are several big suppliers on the market. Since it is three maturity stages that all requires an IT solution, Daltile could consider the requirements for all three maturity stages when choosing the IT solution. Thereby not investing in different software systems at every maturity stage. At the same time, it is not optimal to invest in features that the company are not ready to use, as these features might be outdated when the company finally are ready to use them.

Therefore, it is recommended that Daltile do look at all the maturity stages to see what they are recommended to use, and then use this to approach software developers who can provide them a modular

type of software, which allows them to invest in what they need currently, and then when moving up the maturity stages and the need for more features arrives, the next module can be purchased.

5.4.1 Moving to maturity stage three

As mentioned in the last section, moving to maturity level three will demand a greater software investment. Therefore, at this point it is recommended for Daltile to have the upcoming maturity recommendations in mind when enquiring about possible software investments. As for the first part of the software investment the following gaps are found between the current information technology and maturity stage three:

1. Integrated demand and supply planning software
2. Centralized access for the S&OP team

5.4.1.1 Integrated demand and supply planning software

The software needs to be able to calculate demand forecasts on historical data and combine it with how to plan supply. This will assist the S&OP team during the pre-meetings, and will make calculations transparent, which will make for example inflating sales forecast easily detectable.

5.4.1.2 Centralized access for the S&OP team

The software should be accessible for the S&OP team members when they need it, this will mean that it must be on some shared platform. When working on a shared platform, there needs to be safeguards that makes it possible for more than one person to work with the data at the same time, without interfering with each other's work.

5.4.2 Moving from maturity stage three to maturity stage four

The gaps between maturity stage three and maturity stage four are:

1. Revenue and optimization software

5.4.2.1 Revenue and optimization software

The module needed for maturity stage four is an optimization module, which can help calculate different scenarios based on the historical data (scenario planning). The software can also assist in calculating optimal prices, optimal production sequences to follow demand forecast and capacity plan.

5.4.3 Moving from maturity stage four to maturity stage five

The software features needed at maturity stage five:

1. External partner integration

5.4.3.1 External partner integration

At this maturity stage the software should be able to fully integrate with the data systems at the suppliers and customers. This will make Daltile capable of having real time data, which gives several integrational possibilities on both supplier and customer side, which can be utilized through automated ordering systems. Real time data can help predicting customer orders and create automated ordering agreements. Similar can be achieved on the supplier side. With real time data, issues, abnormalities, and tendencies can be detected early and addressed immediately, which can prevent problems, such as stockouts, increased inventory due to demand changes, etc.

5.5 Strategic Alignment & Performance Management

The data analysis in section 4.6 determined that this dimension is consolidated at maturity stage two. The data analysis highlighted that Daltile is only aligned with the business strategy, and therefore measures how operations meets the sales plan. This mean that the gap analysis for this dimension will firstly focus at achieving maturity stage three. After maturity stage three have been achieved, the way to move into maturity stage four and lastly to maturity stage five will be presented.

5.5.1 Moving into maturity stage three

The gaps found as to move into maturity stage three are:

1. Broader alignment
2. Include performance measures for sales

5.5.1.1 Broader alignment

To move away from the strategic S&OP at maturity stage two, it is important to have the strategic alignment to create vertical link between long-term strategy and the short-term tactics. To do so, Daltile will need to not only be aligned with the business strategy, but also the production strategy. Aligning the business strategy and the production strategy creates a balance and new KPI's that support the tradeoff between the two strategies.

5.5.1.2 Include performance measures for sales

As a complimentary initiative to the former initiative of a broader alignment and creating new KPI's, it is imperative that the performance measures used in creating the new KPI's include sales measurements as sales forecast accuracy. By including performance measures for sales, and making new tradeoff KPI's, the responsibility and accountability for both production and sales departments equals and it will also encourage greater collaboration.

5.5.2 Moving from maturity stage three to maturity stage four

As a standard S&OP is consolidated at maturity level three, it is possible to move into an advanced S&OP maturity stage four. The gaps found to move from maturity stage three to maturity stage four are:

1. Consider strategic alignment with external partners
2. Individual peer to peer evaluation

5.5.2.1 Consider strategic alignment with external partners

At this point external strategic alignment with top suppliers and customers need to be considered. Aligning with top strategic partners, creates a codependent relationship, that could be beneficial for all parties. The aspect that needs to be considered is who the most beneficial partners to create a common alignment with is.

5.5.2.2 Individual peer to peer evaluation

When the maturity stage four is achieved, the training and experience of the S&OP team should have empowered and given them continuously more responsibility. This makes them capable of evaluating each other's performances and thereby helping their peers to improve. Evaluating peers can be extremely sensitive, and it is therefore important to develop a system, that ensures a productive and positive atmosphere for all. It is essential that given and receiving feedback is constructive and productive, and should therefore be based on a feedforward mindset, as not to be an attack, but an improvement solution. The specific procedure should depend on the company, the employees, and the culture.

5.5.3 Moving from maturity stage four to maturity stage five

Maturity stage five is a proactive stage, where external partners play a big role and the S&OP will be assessed on their overall profitability. The gaps of moving into maturity stage five are:

1. Strategic alignment with top external partners are fully integrated
2. S&OP team assessed on overall company profitability

5.5.3.1 Strategic alignment with top external partners are fully integrated

To fulfill the proactive S&OP, strategic alignment should include top suppliers and customers. This alignment is the foundation of all recommended maturity stage five initiatives throughout this chapter. Aligning is an equal collaboration with codependency's and should therefore not be made to serve one side of the agreement.

5.5.3.2 S&OP team assessed on overall company profitability

At maturity stage five, the S&OP team performance management will not be judged on S&OP performance measures alone, but the overall company profitability that is produced. This is because at this stage the S&OP process should be so well integrated that the S&OP team and their planning is the most essential for the profitability.

5.6 Key findings

This section summarizes the proposed initiatives from the GAP analysis by maturity stage. This will be shown as a table to provide an overview, before the next section reflects on the cost and benefit for each initiative. Some initiatives will help to close several gaps and maturity stages. Table 9 will provide further information on that matter.

Maturity stage	Gap	Initiative	Initiative ID no.	References (sections)
Maturity stage one	No gaps	Not applicable	Not applicable	
Maturity stage two	No gaps	Not applicable	Not applicable	
Maturity stage three	Strengthen the collaborative culture	Training, collaborative tasks, visible collaborative learning	1	5.1.1.1
	Responsibility to the collaborative S&OP team instead of individual departments	Training, visible clarified roles and responsibilities	1	5.1.1.2
	Improve external collaboration in the planning phase	Collaborate with top suppliers and customers to collect relevant data	2	5.1.1.3
	Bottom-up process	Empower employees with responsibility	3	5.3.1.1
	Lack of planning software	Collect offers for planning software with the ability to fulfill all of the last three maturity stages of the information technology dimension as to be secured for the future. Preferably the software can be divided in modules as to not invest in parts that might not be needed in the immediate future.	4	5.4
	integrated demand and supply planning software	Ensure the software can fulfill the basic demand and supply planning	4	5.4.1.1
	Centralized access for the S&OP team	Ensure the software is accessible for the entire S&OP team simultaneously	4	5.4.1.2

	Broader alignment	Align business strategy with production strategy to create new KPI's	5	5.5.1.1
	Include performance measures for sales	Identify performance measures for sales	6	5.5.1.2
Maturity stage four	Having cross-departmental teams	Create cross-departmental teams	7	5.1.2.1
	Expanded dataset from external collaborators	Expand dataset from external suppliers	2	5.1.2.2
	Top external collaborators participate in formal S&OP meetings	Invite top external collaborators to formal S&OP meetings	8	5.1.2.3
	The formal S&OP team responsibilities	Training and top management support	1, 3	5.2.1.1
	The employees need to take more responsibilities	Top management empower employees and step back to more supervising role	3	5.2.1.2
	The formal S&OP meetings needs to be bottom-up	Empower employees and top management take a step back	3	5.2.1.3
	Reevaluate the meeting frequency	Discuss if the S&OP meeting frequency is sufficient	9	5.3.2.1
	Making the process more concurrent and collaborate	Create cross-functional teams	7	5.3.2.2
	Balancing the process with external collaborators	Using external collaborator participation in S&OP meeting to create an external alignment	8	5.3.3
	Revenue and optimization software	Add revenue and optimization software	4	5.4.2.1
	Consider strategic alignment with external partners	Investigate possible strategic alignment	10	5.5.2.1
	Individual peer to peer evaluation	Create a procedure for peer to peer evaluation	11	5.5.2.2
Maturity stage five	Employees take full ownership of the S&OP process	Top management enables employees to take full ownership	3	5.1.3.1
	Employees take cross-functional responsibility	Top management empowers employees to take cross-functional responsibility	3	5.1.3.2
	Data from external collaborators are real-time and automated	Create full partnerships with suppliers and customers to give access to real-time data	2, 10	5.1.3.3
	The formal S&OP team ownership	Top management entrust employees to take ownership	3	5.2.2.1
	Full mandate to the S&OP team	Top management gives full decision-making mandate to the S&OP team	3	5.2.2.2
	Organizational understanding of the S&OP	Create understanding of S&OP role in company's overall profit	12	5.2.2.3
	Event driven meetings in addition to regular formal meetings	Introduce and define event driven meetings	13	5.3.3.1
	Dynamic processes	Give cross-functional teams the autonomy to change the processes to fit the need	3	5.3.3.2
	External partner integration	Add module that can integrate external partner data in real-time	4	5.4.3.1

	Strategic alignment with external partners fully integrated	Create strategic alignment with external partners	10	5.5.3.1
	S&OP team assessed on overall company profitability	Performance measures for the S&OP team extends to profitability for whole company	12	5.5.3.2

Table 9 - Proposed initiatives sorted by maturity stage

5.7 Cost Benefit Reflections

According to Table 9 there are identified thirteen different initiatives. These initiatives can be grouped into three types of initiatives. The first type is the one-time initiatives, which are implemented at one time (Initiative number 5, 6, 7, 8, 9, 11, 12, and 13). The second type is the recurring initiatives, which are initiatives implemented at more than one different step (initiative number 2, 4, and 10). The third and last type of initiative are the continuous initiative, which are implemented at one step, and then continues throughout the entire development, developing alongside the maturity stages (initiative number 1 and 2). Furthermore, several of the initiatives overlap in the gaps the are intended to solve, which is natural since several of the gaps are connected, both across dimensions and across maturity. The purpose of this section is to reflect on the cost and benefit of the proposed initiatives. The initiatives are listed in the order their appeared in the key findings in section 5.6, which is also the initiates respectively ID number.

Training (ID number 1)

Training is one of the two continuously initiative types, which means that training will develop with the development of the S&OP process. Training is the key for changing the mindsets of the S&OP team to become a more collaborate culture, and function as a cross-functional unit. Training will make the employees more capable and comfortable, which in turn will make them ready to take on responsibility and ownership of the process. The cost of changing mindset through training is mainly time, in the sense that training takes time, and to change mindsets and habits, it can take even more time. A lot of training will be through applying new mindset to the tasks at hand, and this can mean slower processing. Furthermore, time spend in dedicated training is time not spend on the day to day tasks, and this will mean that the pressure on the tasks might get elevated during the training, especially in the introduction phase. Lastly there will be an economic cost to creating the training.

Collecting external partner data (ID number 2)

Collecting external partner data will create a larger dataset to base the planning aspects on. More customer data will help create better demand forecasts, while more supplier data can help the production planning. Involving partner data, can also increase the relationship with the partners, which might lead to better

and/or more business. Collecting external partner data is considered a recurring initiative, since the need for data is different as the company matures, and therefore new agreements will be needed.

Top management support (ID number 3)

While training in the first initiative makes employees ready to take responsibility and create a bottom-up process, it cannot be achieved without the support of top management. Top management needs to be able to take a step back and allow the employees to drive the process, take responsibility, and in the end take ownership. Top management support is therefore alongside training a continuous improvement initiative that is needed to empower the employees to make decisions. Top management must still play a role through participation and supervision, as to legitimize the mandate given to the S&OP team. The cost of top management empowering the employees, is that they relinquish their own control.

Purchase new dedicated planning software (ID number 4)

The purchase of new software is considered a recurring initiative. This initiative is somewhat special as it is recommended that all the future purchases are considered when purchasing the first software part, and it has therefore been recommended to look for a software that can be bought in modules to fit the company at any given maturity stage, without unnecessary purchases that might get useful in the future. The benefits of purchasing dedicated planning software is the availability of a tool, that will help creating different planning aspects more precise and faster. At the same time, it is centralized so everyone can access and work on the planning simultaneously. The more mature the S&OP the more complex it is, and the more helpful the dedicated planning software is. The software can also be automated to detect issues and tendencies early and this can help prevent problems. The cost of the dedicated planning software is firstly the economic cost of purchasing the software, as specialized software like these are quite expensive. Furthermore, the software will demand training and “growing pains” which can cost temporarily in productivity.

Broader alignment (ID number 5)

The fifth initiative is to align the business strategy with the production strategy. This is a single time internal alignment initiative, where the direction has to be set, and then followed. This strategic alignment will replace the former alignment with just the business strategy, and shift to a balance between the business strategy and the production strategy. This is important as to get the optimal benefits of the collaborative planning. The benefits of this initiative are that both sales and logistics are held accountable for their planning and will therefore be codependent on both their planning being as accurate as possible. The cost

will be an adjustment period for especially the sales department, as they have not been used to being measured on their accuracy.

Include performance measures for sales (ID number 6)

This initiative is also a one-time initiative, and relates directly to initiative 5, as how to measure the alignment of business and production strategies. Since the production plan already is regulated by performance management, including critical success factors for the business part will help establish a balance and control the behavior of the departments, to aim for the most beneficial tradeoff. The cost is also directly connected to initiative 5, and will be the phasing in period, and the diminished freedom for the sales department.

Create cross-departmental teams (ID number 7)

The seventh initiative is a recurring initiative, and it is the creation of cross-departmental teams as part of the increasing cross-functional work and culture of the S&OP team. Making cross-departmental teams will create greater understanding of the work done in other departments, and the different set of eyes looking can create alternative solutions. Collaboration skills will have ideal settings to be improved, and the training initiative will get field testing. The cost of cross-functional team is that employees are taking away from their core competences in their departments, and it takes time and effort to create cross-departmental teams, especially in the introduction period.

Invite top external partners to participate in meetings (ID number 8)

The eight initiative is about collaborating with external partners. Collaboration with the external partners are important in maturity stage four, as this collaboration should lead the top suppliers and customers to participate in the formal S&OP meetings. This collaboration will also contribute in a strategic alignment with the top suppliers and customers. The presence of the top customers at the formal S&OP meeting, can be an insight in the upcoming period that might deviate the demand, like promotions, competitor events, etc. Therefore, adjustments can be made to the forecast as to improve forecast accuracy. Likewise, the presence of suppliers can be an insight in the supply availability, and thereby make information that could affect supply available beforehand, which can help improve the production planning. Furthermore, collaborating closely with suppliers and customers, creates great and symbiotic relationships, which can lead to more and better business. The cost of having close relationship with top suppliers and customers is that it cost time and money to maintain a great relationship. Furthermore, it can cause complications if external collaborators do not have the company's best interest in mind. It can also create a dependency to

which can shift the power balance between the company and their partners. These costs are mostly manageable, if the company are aware of any danger signals.

Reevaluate the meeting frequency (ID number 9)

The ninth initiative is to question the frequency of the formal S&OP meetings. Could it make sense to have more often meeting frequency. This discussion should be had at the entry level of maturity stage four, and after that it should be brought up once a year, where the need is assessed again. The benefit is shorter planning horizons, against the cost of employees having meeting instead of doing other tasks.

Strategic alignment with external partners (ID number 10)

This is in direct collaboration with initiative 8, as the collaboration begins to grow, alignments are needed as to ensure that the relationship is beneficial for both partners. The benefits of an aligned alliance are that the companies in the alliance are stronger together and can thereby help each other to reach their goals. It is important that in order to create a great relationship, both side of the relationship must feel equal in benefits, and it will therefore most often be attached with compromises, which will be the cost of the partnership. Alignment with external collaborators are also a need to have, when the maturity reaches the stage five sharing of real-time data. It is very important to have aligned what the use of real-time data is for, and if it should mean automated ordering agreements.

Create an individual peer to peer evaluation format (ID number 11)

The eleventh initiative is a performance management initiative, where the employees evaluates each other. The format of doing so needs to be discussed, but it is important that the individual evaluation is made in a positive and productive atmosphere, that encourage the employees to improve. This is one of the most empowering tools a top management can give to their employees, but at the same time it is also a very sensitive tool, and the right circumstances need to be provided. It is very important that it is done as a collaboration and not a competition. There will be a time cost, as it takes time away from other tasks, and will usually take longer than a normal top manager to employee evaluation.

Create understanding of the S&OP role in company's overall profit (ID number 12)

This initiative is to create an understanding outside of the S&OP team, to the role the S&OP team has to the overall company profitability, since it is not always easy for employees in other positions to see the big picture, and therefore they do not necessarily understand why the S&OP team have a say in what they are performing. It will cost some time and money to spread the understanding. The benefits however will include greater acknowledgement of the S&OP team and their work and greater understanding of why the

plans are as they are. This will also create a basis of the S&OP team be held responsible to the company's overall profitability and not just the individual planning periods.

Add event driven S&OP meetings (ID number 13)

As S&OP becomes proactive, a big part of it is to be flexible and adaptable. That is why initiative thirteen is a suggestion to add S&OP meetings to regular meetings when there is an event that needs the S&OP teams attention. This means that as soon as an issue, changed tendency, etc. is detected, it is possible to assemble the S&OP team and adjust accordingly, before it develops into a real problem. This effort will be more exact and proactive in along more sharing of data with external collaborators.

Initiatives	Cost	Benefit
Training	• Time spend away from day to day tasks • Slower work during learning curve • Economic cost of training	• Strengthen the collaboration • Improve cross-functionality of the S&OP team • Employees ready for more responsibility • Increase bottom-up capabilities
Collecting external partner data	• Time to collect data • Time to process data	• Better demand forecasting • Better production planning • Better relationship with suppliers and customers • Possible better deals
Top management support	• Top management relinquish control	• Empowers the employees • Allows for bottom-up process • Allows for employee responsibility • Encourages employees to take ownership
Purchase new dedicated software	• Economic cost • Training cost • "growing pains" in introductory phase	• Centralized tool • Higher level of accuracy and responsiveness • Can handle more complex situations • Can detect issues and tendencies at earlier stages • Can automate decisions
Broader alignment	• Phasing in period • Sales department might be unhappy with less freedom	• More accurate sales forecast • More responsible sales department • More collaboration between sales and logistics • More balance between the alignment
Include performance measures for sales	• Phasing in period • Less freedom for sales department	• Creates behavior control for the strategic alignment • Balances the outcome from the business strategy and the production strategy

Create cross-departmental teams	• Introductory phase need time and effort • Employee work away from core competences	• Implements the cross-functional training • Creates greater understanding of other departments • New eyes can create alternative solutions
Invite top external partners to participate in meetings	• Time and money to maintain relationship • Might create dependency and shift the power balance	• Extra knowledge that might influence upcoming demand • Extra knowledge that might influence upcoming supply • More and better business through an improved relationship
Reevaluate meeting frequency	• Time away from other task with more meetings	• More accurate planning with shorter planning horizon
Strategic alignment with external partners	• Concessions and compromises	• Stronger together and can therefore help each other to reach goals • Real-time data agreements, with potential for automated ordering systems
Create an individual peer to peer evaluation format	• Time from other tasks • (Risk) competitive atmosphere can make this into a negative event	• Ultimate empowerment by top management to create positive atmosphere • Feedforward to improve performances • Evaluating others help refine possible leadership skills • Creates good bottom-up synergy • Collaborative environment gets boosted
Create understanding of the S&OP role in company's overall profit	• Time and money to create the understanding	• Employees outside the S&OP team understands why the S&OP team dictate their work • Greater acknowledgement of the S&OP team's work outside of the S&OP • Overall company profit included as critical success factors for the S&OP team
Add event driven S&OP meetings	• Sudden meetings might infringe with ongoing tasks	• Possible to proactively adjust plans based on immediate response • Greater flexibility

Table 10 – Cost benefit of proposed initiatives

5.8 Recommendation

The thirteen initiatives are implemented during three phases. This section will set up a recommended implementation plan for each phase. The section will also take into consideration which initiatives are subject to further discussion before implementation. The section will be divided into three phases, which are coherent with achieving the last three maturity stages of the maturity model in section 3.3.

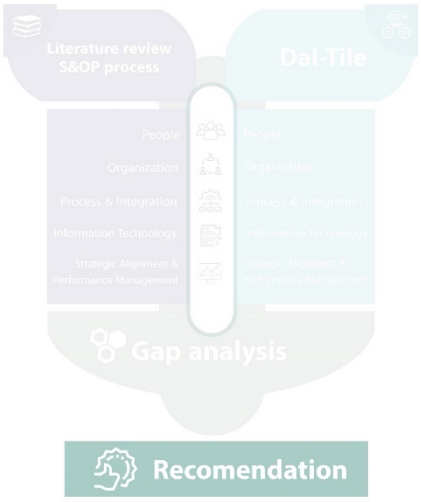

Figure 22 – Project framework recommendations

The first phase will suggest six initiatives that are recommended to the current situation at Daltile, while phase two consists of seven initiatives to start after completion of the first phase. Eventually, the third phase consist of five initiatives. It is important to note that due to the fast pace pf changes in both literature and business practices, there need to be a reflection between each phase to ensure that future plans are still best practices.

The following sections lists the proposed initiatives of each phase before presenting the suggested implementation order. The initiatives are based on the findings made during this chapter and summarized in section 5.7.

5.8.1 Phase one

Phase one is designed to get Daltile consolidated in maturity stage three. To do so, the following initiatives should be completed:

- Training (ID number 1)
- Collecting and incorporating external partner data (ID number 2)
- Visual top management support (ID number 3)
- Purchase new dedicated planning software (ID number 4)
- Broader alignment (ID number 5)
- Include performance measures for sales (ID number 6)

Phase one is divided into the following four steps, see Figure 23:

A mindset change is essential for Daltile S&OP team to move from a reactive S&OP team into a standard S&OP team.

In **step 1,** three initiatives should be launched, namely training, top management support, and broader alignment. These three initiatives kickstarts phase one by beginning to shape culture and mindsets through training while a broader alignment should shape the KPI's that aims to create a balanced framework with both the business and production strategy in focus. The top management support could bring the training in to effect with their support, and by gradually giving more responsibility to the S&OP team. Both training and top management support are considered continuous initiatives - running alongside all the other initiative throughout the three phases.

Step 2 includes performance measures for the business strategy to complete the new balance framework started in step 1. These performance measures aim at sharing accountability of both the sales and logistic team.

Step 3 initiates data collection from suppliers and customers to assist the planning phase. This stage should only include top suppliers and customers.

Step 4 initiates the purchase of a new dedicated planning software. Preliminary analysis and sourcing project to drive the purchase should be completed before step 4 as described in section 5.4.

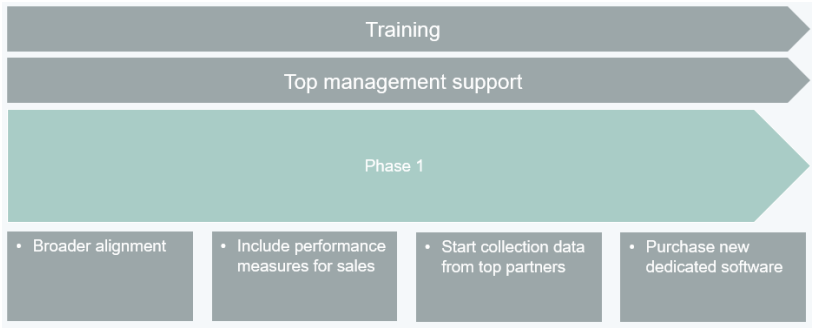

Figure 23 – Phase one of implementing recommendations

5.8.2 Phase two

When Daltile are ready to begin the transition to maturity stage four, phase two will start. Phase two consists of seven initiatives in addition to the two continuous initiatives that are already implemented from phase one. The initiatives that have been suggested for phase 2 is:

- Collecting external partner data (ID number 2)
- Purchase new dedicated software module (ID number 4)
- Create cross-departmental teams (ID number 7)
- Invite top external partners to participate in meetings (ID number 8)
- Reevaluate the meeting frequency (ID number 9)

- Strategic alignment with external partners (ID number 10)
- Create an individual peer to peer evaluation format (ID number 11)

Phase two is divided into the following five steps, see Figure 24.

Step 1 is to develop the strategic alignment to top suppliers and customers and create a framework for a closer collaboration to improve planning. Suppliers and collaborators will be invited to participate in the S&OP meeting to ensure closer aligning with partners.

Step 2 begins with reevaluating formal S&OP meeting structure and frequency. This will be evaluated based on the maturity level and confidence of the members. Yearly reevaluation is recommended. The second part of step 2 is to start creating cross-departmental teams. This will be an extension of the collaborative training and will provide hand on experiences.

Step 3 will be to purchase the next module for the planning software, which will add a revenue and optimization module, see section 5.4.2.1.

Step 4 builds on the data collection from external partners. At this point in time, the data integration should be expanded beyond the top suppliers and customers.

Step 5 is to introduce peer to peer evaluation. Prerequisites are employee training and top management empowerment. A proper format was described in section 5.5.2.2 and 5.7.

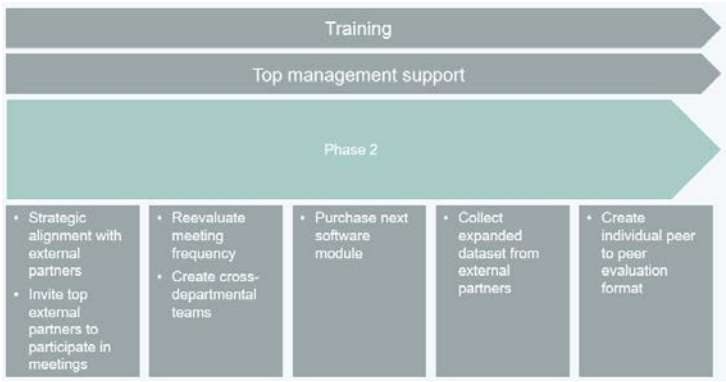

Figure 24 – Phase two of implementing recommendations

5.8.3 Phase three

As Daltile moves into maturity stage five, phase three will start. During this phase the continuous initiatives that also have been part of the previous two phases will have defined the company culture, clarified the responsibilities, and encouraged bottom-up ownership of the process. Top management support is

essential in phase three, as the S&OP team will have full decision-making mandate of the S&OP process, see section 5.2.2.2. Phase three consists of five initiatives.

- Collecting external partner data (ID number 2)
- Purchase new dedicated software module (ID number 4)
- Strategic alignment with external partners (ID number 10)
- Create understand of the S&OP role in overall company profitability (ID number 12)
- Add event driven meetings (ID number 13)

Phase three are divided into the following three steps, see Figure 25:

Step 1 introduces event driven meetings to supplement the formal regular S&OP meetings.

Step 2 is initiated by creating full alignment with strategically with suppliers and customers, creating the agreements needed for collecting real-time data, and making agreements on how these data can be used e.g.to perform automated ordering. Another part of step 2 is to acquire the next software module, that will enable real-time data handling and automated ordering.

Step 3 consist of internal education to ensure that the whole company understands the role of the S&OP team, and how it contributes to the company profitability. This provides the basis for holding the S&OP team accountable for the entire company profitability as their critical success factor.

Figure 25 – Phase three of implementing recommendations

5.9 Chapter summary

This chapter has contributed with an analysis of the gaps identified on the basis of chapter 4.0. After analyzing the gaps, the chapter presented initiatives to close these gaps, and increase Daltile's S&OP maturity level. The initiatives have been presented in a three-phase implementation plan, see Figure 26. The following chapters will provide a discussion of the recommended solutions in chapter 6.0, followed by a conclusion in chapter 7.0.

Figure 26 – Three phase implementation plan

6.0 Discussion

Daltile is a company that felt their S&OP process could need an external view to help them develop further. That lead to the creation of this study, which was given the task to assess the current situation and make recommendations to what the next step for Daltile is. To efficiently do so, it was necessary to create a new maturity model based on the maturity model by (Grimson & Pyke 2007). After a thorough investigation, this study found that Daltile have initiated their journey of S&OP and the findings showed them to be at a reactive maturity stage of S&OP as per the maturity model created and visualized in Figure 14 at the end of chapter 3.0. However, Daltile are on their way into a standard S&OP maturity stage, having achieved several of the aspects required to be considered at that stage. A gap analysis was performed to find where the improvement possibilities were. The recommendations made by this study was a three-phase implementation plan see section 5.8.

The following subsections will aim to present some additional interpretations of the findings of this study.

6.1 The Maturity Model

The maturity model was created on the basis of the maturity stages from the model by (Grimson & Pyke 2007). This was because this model is used as reference point in most literature about assessing S&OP and about maturity in S&OP. Of the literature presenting their own models, most of them also used these five stages referring back to (Grimson & Pyke 2007). The dimensions for the model however were changed into new dimensions fitting the findings of more updated theory creating three new dimensions, redefining one of the old ones, and keeping one. The dimensions were created to reflect the aspects needed to successfully operate a S&OP process. The dimensions will be briefly described, and then discussed where the findings can be challenged.

The first focus was on creating the right collaborative culture, which demands the right conditions set by top management and the right mindsets with the employees.

The second aspect was based on responsibility, ownership, and decision making. One of the viewpoint is that since the maturity starts with top-down management and need to be more bottom-up the task is on top management to take a step back and give more responsibility and empowerment to make decisions. Another argument could be that it should be up to employees to show they want more responsibility and fight for ownership of the process.

The third aspect is about the process and integration hereof. This is a dimension that is about meetings, pre-meetings, and how these are executed. This dimension is clear according to theory, and is not seen to have any possible different outcome

The fourth aspect is the information technology and the need hereof. The literature is in agreement on the need for a dedicated planning software from maturity stage three. However, the literature does not really take into account that three different stages of dedicated planning software, could be combined. This study has discussed this in the section 3.3.4. That discussion resulted in a recommendation that a software that can be divided into modules, as to be able to consider future software requirements and at the same time not need to invest in software not needed immediately is recommended. However, this recommendation might not advocate for the best available option for the current state, and with technology changing with an ever increasingly fast pace, it might not be the smartest solution to make the decision on what might never be relevant.

The last aspect of the maturity model is strategic alignment & performance management. This dimension focuses on the two vertical ends of the S&OP framework, which is strategic alignment to set the goals, and performance management that creates the behavioral control to keep the process on the path towards the goals. This dimension could arguably have been divided into two different dimensions, which could simplify the maturity steps. That was however not case with this study, as they were seen as so codependent to function optimally, that they were made to be complimentary of each other.

6.2 recommendations

The recommendations are as mentioned a three phased plan. These recommendations are based on a goal of reaching proactive S&OP. A proactive S&OP demands a lot from the S&OP team, the top management, and last but not least a lot from collaboration with suppliers and customers. These aspects are needed for Daltile to have an internal discussion on where they see the company going.

The goal does not need to be defined by a maturity stage, as it is possible to pick the aspects of S&OP that the company finds appealing to what they want to achieve. At the same time, it is not necessary to achieve a certain maturity stage for all dimensions of the S&OP process in order to move forward, as the recommendations are planning. This is also an issue that Daltile should discuss continuously as it becomes relevant. At some points it can be relevant to continue the development of one dimension, before another dimension has reached the goal of the current phase.

Lastly, it is important that the plan is evaluated between phases as both theory, tools, and business processes might change a lot before completing a phase. In a situation where something has changed, it must be accounted for and the next phase adjusted accordingly.

6.3 Validity of the study

Validity has been prioritized throughout this project. As to maintain validity there are some aspects that are controllable and others that are not.

The aspects that were not controllable were the sample size of the data collection interviews, which ended up being one low of the bare minimum according to (Saunders et al. 2008). Unfortunately, the whole department consisted of three people, which was not enough for the academically minimal sample size, but as a reality it was everyone in the department, which meant that all information within the department should be obtainable. At the same time the answers were so similar, that it can be either one of two things, there are a consensus on how things are, or two the answers were dictated. As the questions were not send beforehand, and the interviews were done after each other with no breaks, there were no chance to rehearse the answers. As a recommendation for further data collection would be to insist on interviewing from more sites and departments to get a bigger and less homogenous sample size.

As for what was controllable in order to ensure reliability was a complete transparency throughout the project. All limitations and reasoning have been described in the project, as to ensure credibility. Developing a clear, transparent, and well-structured framework, will also help the reader to understand where outcomes come from and why the deductions are as they are.

7.0 Conclusion

This study has investigated how S&OP are optimally executed according to literature, with a thorough literature review. This literature review created the basis of how the S&OP process at Daltile were investigated and analyzed. With the literature review and the data analysis, a gap analysis was conducted to investigate where Daltile could improve their S&OP process and what initiatives should be implemented to do so. 32 gaps where found between current state and a proactive S&OP.

With the literature review a maturity model was created, and this model created the basis for the prioritization of the suggested initiatives. These prioritizations created a three-phase recommendation for Daltile as to reach a proactive S&OP process.

There are 13 different types of initiatives divided over the three phases. Some initiatives will help more than one gap and some initiatives will be introduced in more than one phase. This means that the 13 different initiatives will be introduced over the three phases 22 times

Phase one consists of six initiatives that are implemented over four steps as illustrated in Figure 27, see section 5.8.1.

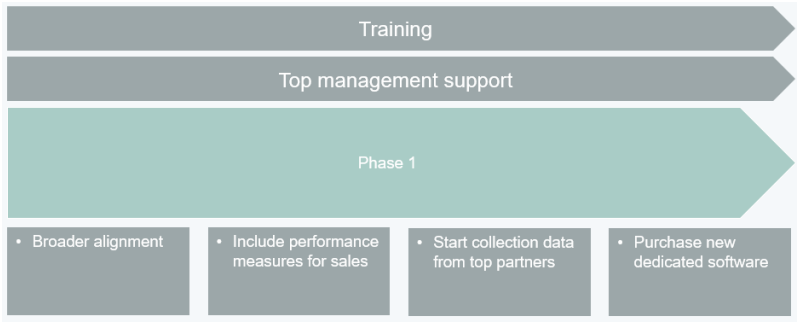

Figure 27 – Phase one of implementing recommendations

Phase two has nine initiatives implemented over five steps as illustrated in Figure 28, see section 5.8.2.

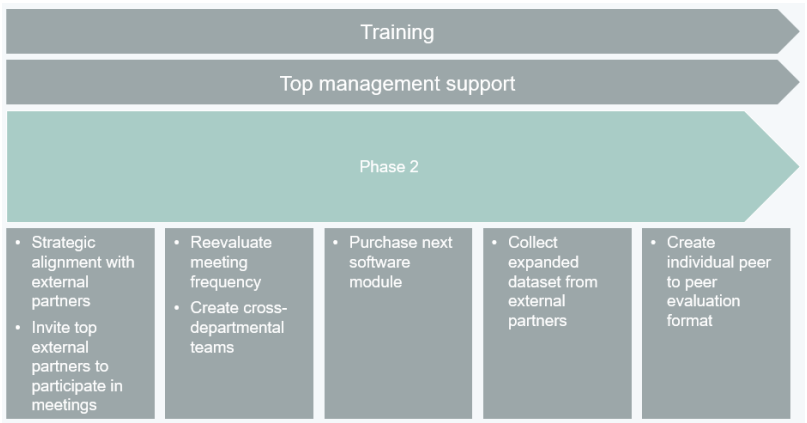

Figure 28 – Phase two of implementing recommendations

Phase three has seven initiatives over three steps as illustrated in Figure 29, see section 5.8.3 for details.

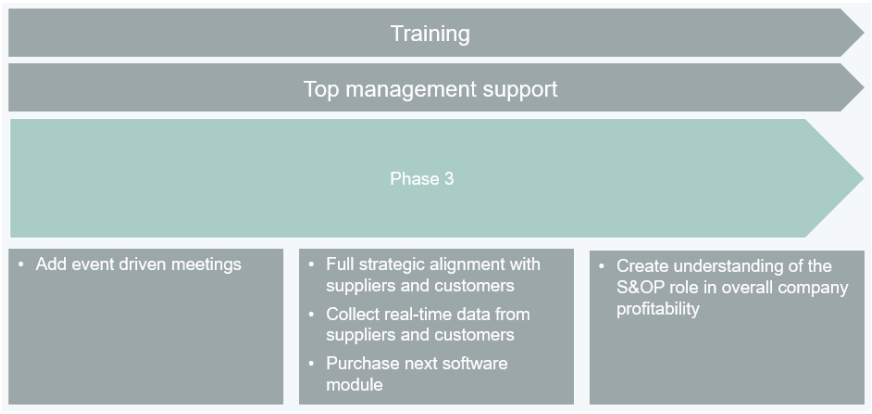

Figure 29 – Phase three of implementing recommendations.

The full three phase implementation plan will then look like Figure 30.

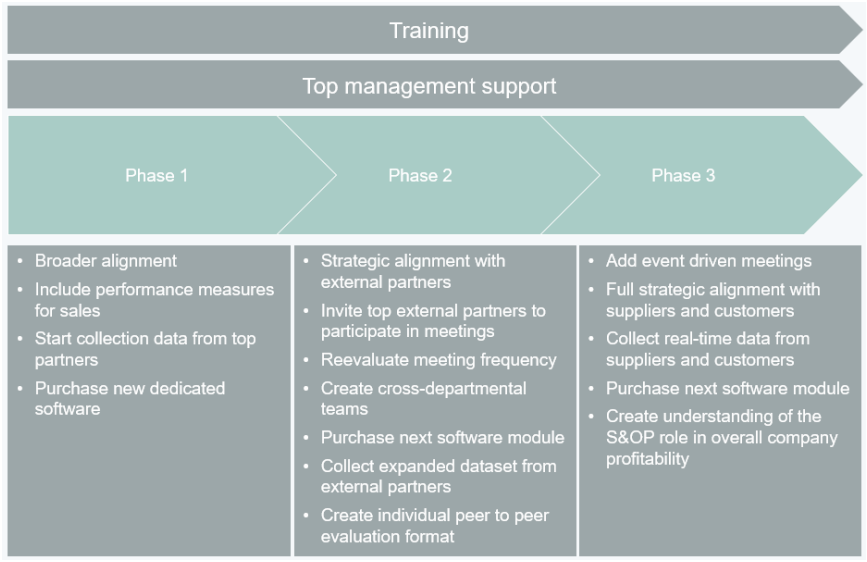

Figure 30 – Three phase implementation plan

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