Sales and Operations Planning:
Design and Implementation of S&OP process in a multinational company

Gonçalo Maria Eva Ferreira Neves Lima

Advisor: Ricardo Reis

Dissertation submitted in partial fulfilment of requirements for the degree of MSc in Business Administration, at the Católica Lisbon School of Business and Economics

September, 16th 2013

Abstract

The aim of this thesis is to evaluate theoretically the maturity of a practical Sales and Operations Planning process throughout its design and implementation phase, in a multinational company.

The company under scrutiny in this thesis is Aker Solutions Process Systems. As a part of the Aker Solutions group, Process Systems is a leading global supplier of processing equipment for oil, water and gas, operating worldwide. The company´s operational objective when implementing this process was to optimize the utilization of resources in it´s five different Business Units. The actions undertaken by the company to develop and implement a Sales and Operations Planning process were carefully record and posteriorly analysed. Sales and Operations Planning is a recognized cross-functional business process, designed to allow the company to synchronise supply and demand, bridge strategic planning with daily activities, and by reviewing performance measures, push continuous improvement, and cross-functional integration (Grimson and Pyke 2007; Dwyer 2000; Cox and Blackstone 2002, Gregory 1999).

The evaluation of the maturity of the Sales and Operations Planning process in question is done according to two different models. The Grimson and Pyke Model described in the 2007 paper *"Sales and Operations Planning: an Exploratory Study and Framework"* and Lapide´s 2005 *"Four-Stage S&OP Process Maturity Model"*. There are three distinct evaluation periods, the first in an initial stage before the implementation of the S&OP process, one in half way through the implementation of the S&OP process and a final after the implementation of the S&OP process.

The results suggest that theoretically by the third evaluation of the process the implementation was achieved and the process presented a level of maturity that should allow the management to use the results of the process to define resource optimization actions. However, the practical results of the process suggest that by the third evaluation, the process is not yet able to produce any useful information.

Acknowledgments

I would like to thank David Merle that gave me this amazing opportunity, to write my thesis in a real high profile business environment.

I am also extremely grateful to Børre A. Svenn for his patience, guidance and wiliness to share his vast experience in both the practical work and in the writing of this thesis.

I would also like to thank my Master Thesis advisor, Ricardo Reis, who always was always available to provide useful and constructive advice.

Lastly, I would like to thank my family and friends that helped me through this great endeavor. Special thanks for Tone Weggeberg for putting up with me for all this months and always pushing me to do my best.

Table of Contents

List of tables

List of Figures

List of Abbreviations

AKSOPRS – Aker Solutions Process Systems
APAC – Asia-Pacific and Australian Continent
BU – Business Unit
EMEA – Europe Middle East and Africa
EVP – Executive Vice-President
IT – Information Technology
NCS – Norwegian Continental Shelf
OP – Operations Planning
OPC – Oil Partner Company
SP – Sales Planning
S&OP – Sales and Operations Planning

Chapter 1, Company Description

1.1 Aker Solutions – From a workshop to a multinational group

Aker Solutions is a worldwide provider of oilfield products, systems and services for costumers in the oil and gas industry.

Aker Solutions started as a small mechanical workshop on the banks of the river Aker in Oslo more than 170 years ago. Originally its core activities included shipbuilding, manufacturing components for machinery, and equipment for clients in the iron and non-ferrous metal industries. After the discovery of oil and gas in the North Sea in the 1960s, the company shifted its focus to oil and gas market. Shortly after the company became a driving force in the development of oil and gas products, such as subsea fields, or floating production concepts.

More recently, in 2002, Aker Maritime (soon to be Aker Solutions) joined forces with Kværner, another Norwegian company. Together they created a strong entity, with activities in multiple industries such as oil and gas, engineering and construction or shipbuilding, under the name of Aker Kværner. Finally during the first months of 2008 the company announced a new name: Aker Solutions.

Nowadays Aker Solutions is one of the world´s leading providers of oilfield products, systems and services. According to Aker Solutions, they offer the best solutions to their costumers for every stage of their field´s exploration time. Today Aker Solutions is a company group with more than 28,000 people between employees and contract staff in 30 different countries, and has yearly revenues of 44 billion Norwegian Kroner (around 5.8 billion Euros).

Currently Aker Solutions is organized in nine independent business areas, each one with a distinct range of products aimed to serve the different stages in the life of an oil and gas field. See picture 1

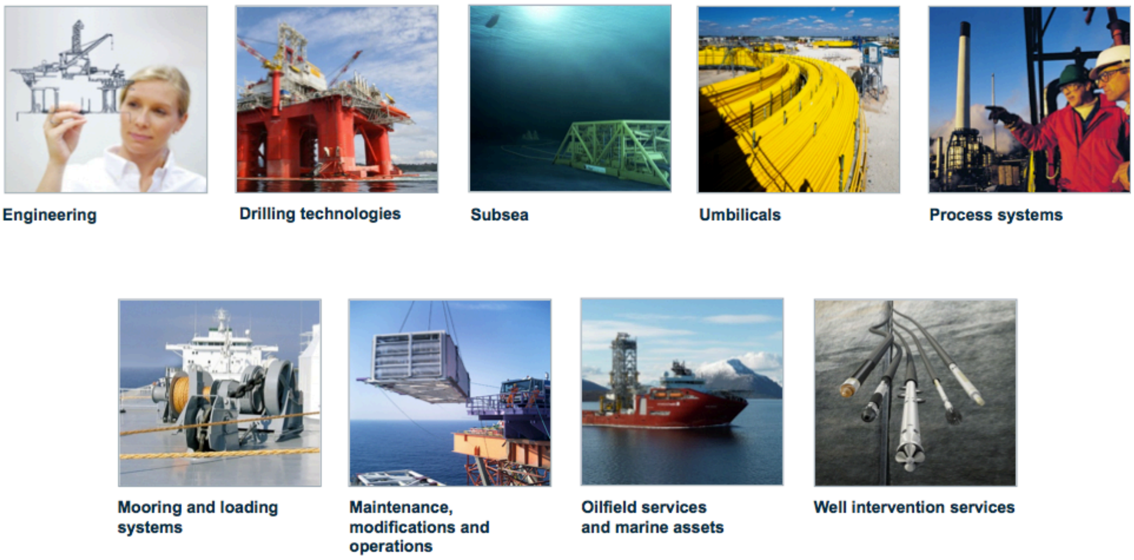

Figure 1- Aker Solutions' nine Business Areas

1.2 Aker Solutions Process Systems

The following thesis will focus on Aker Solutions Process System Business Area (AKSOPRS).

As one of the Business areas of Aker Solutions, Process Systems is a leading global supplier of processing equipment for oil, water and gas. Process Systems provides Conceptual studies, detailing engineering, fabrication and assembly of process equipment skids and modules, as well as proprietary internals, and critical components for non-Engineering Procurement and Construction deliveries. AKSOPRS counts more than 600 employees spread out over five different business units (Americas, Brazil, EMEA, NCS, APAC), as shown in Figure 2. In 2011, AKSOPRS had 198 million euros in revenues, representing 5% of the total group´s revenue that year.

Figure 2 - Aker Solutions Process Systems Business Units

1.3 Business Model

AKSOPRS is one of the main players in a sub industry within the oil and gas industry. The role of companies like AKSOPRS is to provide oilfield products, systems and services to the companies that own or explore the oil or gas fields. In simpler words, the role of AKSOPRS, and other similar companies, is to provide to its clients (normally big oil companies like BP, Total or Statoil) the necessary feasibility studies, engineering designs, or specific hardware modules for the oil companies to explore their oil or gas fields efficiently. The companies will further on be referred to as “Oil Partner Company” (OPC) in the current thesis.

The sub industry works in a global project-based business model. A typical project in this industry has a large number of players, ranging from multinational oil firms to small local screws producers. The relationship between the agents in this type of project is linear and three folded, as illustrated in Figure 3:

(1) The oil firm awards a contract to a OPC company to build a part or all of the infrastructure necessary for the exploration of the field (e.i platform)
(2) The OPC then outsources some sub parts of this contract to other specialized OPCs
(3) Finally, both the main OPC and the sub contracted OPCs will buy parts from local or global fabricators.

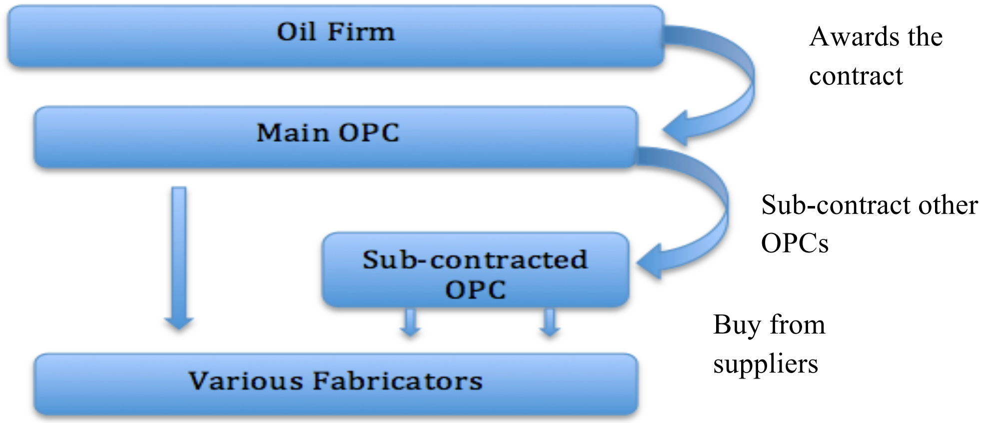

Figure 3 – OPC Industry dynamics

The value of a project in this kind of sub industry can range from 100,000 Euros, to several hundred million Euros, and the project timespan from couple of weeks, to several years.

Chapter 2, Literature Review

2.1 The Sales and Operations Planning concept and goals

Sales and Operations Planning (S&OP) is a cross-functional business process/tool, designed to allow the company to synchronise supply and demand, bridge strategic planning with daily activities, and by reviewing performance measures, push continuous improvement, and cross-functional integration (Grimson and Pyke 2007; Dwyer 2000; Cox and Blackstone 2002, Gregory 1999).

S&OP is a cross-functional business process: the S&OP process occurs within the business functions, and needs the combined contribution of several functions across the company, such as sales, operations or finance. In an organizational behaviour point of view the objective of the S&OP is to drive alignment and integration of functions at a planning and operational level, through a defined set of processes, reporting steps and validation meetings. This cross-functional alignment and integration is for some authors an essential feature for a company that wants to survive in a global, and highly competitive, economy like the one apparent today (Bowersox et al 1999, Oliva and Watson 2009).

To achieve a match between supply and demand, different authors defend two different types of planning: Some advocate a reactive approach where supply adapts to demand, while other authors support an aggressive tactical approach, where demand is adjusted to the supply capability in place (Grimson and Pyke 2007; Dwyer 2000; Olhager et al 2001; Feng 2008).

To facilitate the bridging of the strategic plans with daily activities, a set of meetings between managers and operational people are arranged during the S&OP process. The objective of such meetings are to validate the information gathered from the functions, and define actions to conduct the daily business, according to the strategic view of the company (Oliva and Watson 2009, Grimson and Pyke 2007)

The effects of the S&OP process in the companies performance appear to be positive, however the extent of the effects are still not fully empirically proven (Thomé, Scavarda, Fernandez and Scavarda 2012). Nonetheless, it is possible to find several authors whom use a less systematic approach, proclaiming the connection between the firm performance and the S&OP process, and the sub-sequential alignment of Supply and Demand. Higher costumer service, less inventories or an efficient management of the supply chain are only some of these advocated benefits (T.F. Wallace 2004; Lapide 2004b; Grimson and Pyke 2007; Cacere et al 2009).

A benefit some authors advocate is linked with the mitigation of the "Bullwhip- effect". The Bullwhip-effect occurs when a temporary spike in demand sends an increasing backlash through the supply chain of the company, misaligning supply and demand (bigger supply than demand), which again leads to costly supply chain dysfunctions, and loss of efficiency through the whole productive process. With an S&OP process in place, supply and demand should always be aligned, and in that way prevent the Bullwhip-effect.

When searching for more empirical evidence of these effects, few papers are found regarding the topic, and the results they present are only partial, when compared to the extent of S&OP process. The following publications touch upon the subject:

- McCormack and Lockmany (2005) found significant positive correlations among informal organisations, formal groups, integrating roles and network building with firm performance.
- Hadaya and Cassivi (2007) found that the effect of the integration/collaboration aspect of the S&OP process is mediated by the use of inter-organisational information systems
- Olhager and Selldin (2007) found that the S&OP process reduces the negative effect of the market uncertainty in the company performance
- Feng and Shopie D´Amors (2008) – Found that a cross-functional integrated planning has a better results, than an independent functional planning.
- Olivia and Watson (2010) hypothesized that the S&OP process has effects in the company performance even when incentives are misaligned within the company.

According to the synthesis done by Thomé, Scavarda, Fernandez and Scavarda in 2012 it is possible to group the S&OP process goals in to 5 distinct categories:

- *"Alignment and Integration"* – Organizational alignment, supply and demand balance, cross-functional integration or supply chain integration
- *"Operational improvement"* – improvement of sales and operation forecast, stock reduction, optimize the allocation of capacity, supply chain optimization and increase in business control
- *"Results focused on a single aspect"* – Improve supply chain performance, minimize demand distortions, enhance revenues or reduce costs.
- *"Results based on trade-offs"* – optimize profits (revenue vs cost), optimize costumer service vs inventory or optimize supply chain costs.
- "End Results" – Improve financial indexes such as R-on-Investment or Earnings Before Interests, Taxes, Depreciations and amortizations.

2.2 The S&OP Process

The typical S&OP process has five steps (Grimson and Pyke 2007;Kruse 2004; Rooney and Bangdert, 2001; Lapide 2004b, 2005a, Wallace 2004).

1)

First, sales personnel gather information related to sales with the intent of drawing the sales forecast. This forecast should be drafted without any production capability restrains, and only mirror the amount that the costumers are willing to buy. When drafting this sales forecast, the main variables behind possible variations in the demand forecast should also be considered in a scenario-building approach.

Another relevant aspect of the first step, is the definition of the timespan of the analysis, normally ranging between 6 to 18 months. This 12-month variation is linked to production, the consumers and the business cycles of each industry. For instance in a project based industry such as the oil & gas industry, the advisable timespan is 12 months, while in long production lead time industries, such as the pharmaceutical industry, the used time span can be that of several years.

2)

Second, the Operations group collect information about the available production capacity, supply chain capability, manpower availability, and storage capabilities. The aim of such an exercise is to, with the collected information, draft a production plan to meet the sales forecast, which resulted from the first step of the current process.

3)

Third, the S&OP team formally meets and compares both sales forecast and operational capacity, and with this information in mind, come up with a set of actions to improve the company´s operational efficiency.

The S&OP team composition varies from industry to industry, but in general it should have representatives from the operations and sales team, preferably the elements that took part on the first two steps. Additionally, both the financial and strategic functions should also be represented in the S&OP team.

Moreover the presence of a member of the legal team can in some industries be useful. As a practical example, the S&OP team in a company from the oil and gas industry might include representatives from Operations (Project Execution, Supply Chain, Quality and Tender), Sales (Business Development), Finance, and in particular cases, Legal. This results in a team of around nine fixed elements, plus any variable attendees of approximately ten employees.

Some authors also advocate that the appointment of an S&OP responsible, increases the effectiveness of the process greatly (Grimson and Pyke 2007, Mansfield 2012). Whoever appointed the responsibility, should have enough power to successfully push the implementation and execution of the whole process.

4)

Fourth, there are the implementations of the set of actions resulting from Step 3. This set of actions are normally aimed to both sales and operations functions. However depending on the type of planning in place (aggressive or reactive), these actions might only be focused in one of the teams.

5)

In the fifth stage, the results of the set of actions put in place during the fourth stages are measured. The development of a set of measurements to evaluate the results and the level of implementation of tool is essential for continuous improvement. However, to define this set of measurements is not an easy task since, the measurement parameters for S&OP effectiveness are rare, and industry dependent (Grimson and Pyke 2007).

Literature suggests several measurements to evaluate operations, such as capacity utilization or variance in standard cost, and to evaluate sales such as sales growth or market share. However the measurements to evaluate empirically S&OP effectiveness as whole are rare, as mentioned previously

A final note regarding the general S&OP process is regarding the S&OP cycle timespan. Literature suggests that the S&OP process should operate in a monthly cycle (T.F Wallace 2004). However recent science publications show there is a tendency to reduce this time to an almost event-driven or daily event (Grimson and Pyke 2007, Lapide 2002).

2.3 Implementation

Implementing an S&OP system implies a big change, since business culture, business processes and IT tools have to be adapted to achieve a full integration of the different functions in the process (Lapide 2005, Grimson and Pyke 2007):

- Change in mentality is essential. The S&OP process is defined as a cross-functional process, thus a full integration at a planning and operational level between the different functions, is crucial to successfully run the process. This part of the implementation process is even more relevant when we see that, especially in a highly differentiated organizational context such as a multinational corporation, each business function tends to specialize in its own part of the planning process, and isolate itself from the other functions. Such behaviour has roots in structural causes such as misalignment in reward and evaluation systems, and tends to generate conflicts between functions when the time to match supply and demand arrives (Oliva and Watson 2009, Shapiro 1977).

To achieve cross-functional integration it is necessary to have different managers with different incentives and goals work together. Some authors defend that this often requires a change in the incentive model (Lapide 2005b), however certain recent studies show it might be attained by implementing a business process that promotes informational procedural and alignment quality (Oliva and Watson 2009). Regardless of which approach is used to transform the mentality of the company, it appears achieving a uniform way of thinking and acting is essential to achieve a successful S&OP process.

- Change in business process: To establish the S&OP process, it is necessary to put in place a set of periodic meetings and tasks, and a set of defined operational steps to feed the meetings and tasks. This requires a re-arrangement of schedules and day-to-day activities from the organization. To feed the first two steps of the typical S&OP process is necessary to provide forecast and operational input, in order to build both the demand forecast and the supply capacity. To provide such an input, it might be necessary to add extra reporting processes to both sales and operations´ day-to-day activities.

- IT Tools, are essential to the process, but not enough to harvest the full range of benefits the S&OP process can provide the company (Lapide 2004b). However, the level of required automation and computational sophistication varies within the several levels of S&OP maturity. In a introductory level to S&OP the necessary IT support is quite low, in some cases a simple spread sheet and a dedicated employee might be enough. Whilst in a more advanced stage, a dedicated tailor-made set of programs might be needed. In those stages, the amount of information used in the process is too big to be handled manually.

To operate a mature S&OP process, it is necessary to have in place three different, or a three-sided, software (Lapide 2004b), since the process deals with three major types of information:

- Sales or Demand: The system needs to be able to support the production of the sales forecast. A feature that allows the production of "what-if scenarios" is regarded as essential.
- Operations or Supply**:** The system needs to be able to support the production of the capacity plan, and to mirror perfectly the operational and capacity limitations of the company.
- S&OP environment**:** The system needs to be able to cross, display and change the information from both the Sales and Operations parts of the system.

Chapter 3, Methodology – Maturity Models

The literature is rich in models to assess the level of maturity of the S&OP process in a company (Thomé, Scavarda, Fernandez and Scavarda 2011). Two of these models were picked to evaluate the evolution of the S&OP process, and is described in the following section of the current paper.

The first model picked is the Grimson and Pyke Model, presented in the paper *“Sales and operations planning: an exploratory study and framework”*. The model is chosen because, as it is explained in the Grimson and Pyke´s paper, it was designed based in the S&OP literature analysis, and on 15 in-depth company interviews, conferring to it a degree of reliability uncommon is this field. Furthermore, structurally, the model is complete, since it evaluates each S&OP process on five different dimensions in a 5-ranked scale.

The second model used in the current paper is the Lapide Model presented in the third part of the author´s series named *“Sales and Operations Planning”*. The model was chosen because of the quality of its structure, and the author´s experience in the field. Larry Lapide has contributed greatly to the S&OP theme, both with his experience as a manager, and with his publications.

3.1 Grimson and Pyke Model

The section 3.1 of this paper was written using as a base the paper *“Sales and Operations Planning: an exploratory study and framework”* from Grimson and Pyke, 2007

J. Andrew Grimson and David F.Pyke in their paper *“Sales and Operations Planning: an exploratory study and framework”* present a 5 stage framework that include both business and information processes to assess the maturity of the S&OP process in a company. To built this framework the authors based their research in previous models, focusing specially in two the six staged Aberdeen Group´s S&OP competitive framework that ranks a company against its industry standard and Lapide´s *“Four-Stage S&OP*

Process Maturity Model" that assess the current S&OP status of a company and identifies the steps the company needs to take to achieve the optimum level of S&OP.

	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

Table 1- S&OP Integration framework
Grimson and Pyke 2007 p.5

The goal of the Grimson and Pyke model is profit optimization through the integration of the sales, operations and finance function´s plans.

This framework classifies the companies in five different ranks, from "No S&OP Processes" to "Proactive" across five different dimensions - "Meetings & Collaboration", "Organization", "Measurements" which are business process related, "Information Technology" and "S&OP Plan Integration" which are information process dimensions.

The "Meetings and Collaborations" parameter assesses the level of effectiveness of the human component in the whole S&OP process.

In a company ranked with Stage 1 in this parameter there are no formal meetings and all of the functions work independently and sometimes "against" each other (misalignment of incentives). In these cases planning is done with a silo mentality.

At Stage 2, S&OP starts to be discussed at a senior level, the sales responsible and the operations responsible regularly. However the meeting is focused in the financials indexes of the company, planning is still done independently and integration is not achieved. Furthermore as in the first stage, one of the big risks of this second stage is that by focusing only in the financial aspect of the company, the indexes under analysis are only the ones that drive sales failing to represent the market or the operations environment. Focusing only on the sales driving indexes the company will take decisions taking in account only a part of the relevant information.

In Stage 3 both sales and operations functions hold their own pre-meetings to prepare their plans for the formal S&OP meeting At this point both sales and operations plans are not a fully detailed plan, they are more of a rough sketch considering only main suppliers and costumers. In the S&OP meeting the aim now is to integrate both sales and operations plans.

The fourth stage is only an enhance of Stage 3, now both clients and suppliers take part in the S&OP meeting and more and smaller clients are included in the sales and operations plans.

In Stage 5 event-driven meetings are added to the Stage 4 processes, now all of the information is available and updated live for employees and partners, the aim at this stage is to give S&OP personal enough, accurate an timely information in order to allow them to tackle problems immediately after they appear.

The “Organization” dimension is focused on the S&OP structure, in other words this parameter assesses the level of organizational commitment of the firm with S&OP. In a company in the Stage 1 of the “Organization” parameter, there is not a S&OP function or any employee with specific S&OP responsibility. In a Stage 2 company there is not an official S&OP function, however there are some employees executing some S&OP tasks. Such as crossing the sales plans with the operations plans to fulfil the financial objectives. In a company with a S&OP Organization maturity of Stage 3, there is an official S&OP function. However it is not independent, it operates under another function. A Stage 4 organization has S&OP as an independent function with representation at a senior management level. Stage 5 has the same characteristics of Stage 4 the only difference is that now S&OP is understood and respected by the whole company. The whole company sees the benefits, embraces the S&OP process and takes part actively in it.

The “Measurements” parameter goal is to evaluate the measurements used to assess performance and the effectiveness of the S&OP process. In Stage 1 of this parameter the company has no measurements in place beyond the standard financial accounting system. Stage 2, the company now assesses to which degree the operations plans meet the sales plans. In Stage 3 an extra measurement is added, now the sales function is measured in how accurately their sales forecast is when compared to reality. In a company with a Stage 4 “Measurements” parameter, two extra measurements are included in the previous lot.

- New product introduction effectiveness – normally operational measurements are designed to evaluate products outside of the introductory phase. When evaluating products in this initial phase of their life the normal operational measurements tend to miss evaluate this products effects on the company performance. Therefore there is a really need for this type of measurements.
- S&OP effectiveness – feedback from all of the entities taking part of the process should be gathered and improvements should designed be implement. Furthermore functional measurements can also be used, the S&OP process should increase forecast accuracy and reduce inventory size over time.

Stage 5 adds profitability to the previous stage S&OP measurements. In this stage reaching the objective no longer is only the functional manager responsibility, the S&OP team is now also responsible for the reaching of that objective. Profitability is seen as a cross functional responsibility.

The “Information Technology” parameter is focused in the information process instead of the business process. In other words, this parameter measures how evolved is the IT tool supporting the whole S&OP process. In Stage 1 the companies has some individual spreadsheets owned by different managers that do not share the information or consolidate it. In Stage 2 the spreadsheets are still owned and updated separately but there is some degree of manual consolidation. A company with a Stage 3 IT tool already has an

automated way to centralize the information. At this point some type revenue or operations planning software is in place.
In Stage 4 the company has both revenue and operations optimization software, however the plans are not optimized jointly (separately or sequentially). Furthermore in this stage an *"S&OP workbench"* is in place, this is an automated tool to share the supply and the demand information throughout the S&OP team. Stage 5 is currently above current IT programs capacity, but the authors reckon that this will be the next step for S&OP software. This software will encompass all aspects of both sales and operations. Providing to the company total information regarding all of the variables that influence the optimization point between sales and operations all in real-time. Features like real-time cross-functional solutions will allow the company to react quicker and more accurately to market shifts, striving for profit optimization.

The "S&OP plan integration" parameter measures how effectively the company defines its sales plans, operations plans and how well these plans are integrated. In other words this parameter measures the extent both the operations and sales plans interact and take in account each other's limitations. In Stage 1, the company has no S&OP planning. The Operations function only tries to meet the incoming orders without any previous planning. In Stage 2 the process is run by the Sales function that defines its sales forecast without any operations input, the interaction between function is minimal and only exists in one way. In Stage 3 the whole process is still sequential, and the Sales function is still running the show, however now some input from operations is considered and adjustments are made. At this stage the plans already take into consideration both business and financials goals. The interaction between the two functions already exists in a two-way stream although not in even terms and the more variables are considered in this interaction. A Stage 4 process is developed by both the sales and the operations function in a concurrent way, at this point capacity limitations are also considered and used to adjust the sales plans. At this point, both the input from Sales and the input from Operations have the same relevance when building the plans. At the Stage 5 the process reaches its peak. Now not only supply and demand are aligned in a way both sales revenues and operation efficiency is achieve but also optimal profit is attained. The amount of variables considered into the plans increases considerably, pricing constrains, competitive actions or supply chain constrains are now considered. The interaction is perfect both functions act as one. According to the authors this stage is still impossible to achieve since, as mentioned previously, the software necessary to support such a process is not yet available.

3.2 Lapide´s *"Four-Stage S&OP Process Maturity Model"*

The section 3.2 of this paper was written using as a base the paper *"Sales and Operations Planning Part III: A Diagnostic Model"* from Lapide, 2005.

Larry Lapide presented his model in the third and last part of his "Sales and Operations Planning" series. The objective this final part of the series was to help companies to push their S&OP process closer to the ideal process presented in Part I of the series. The model categorizes companies in four different maturity stages and evaluates three different aspects of the S&OP process (Meetings, Processes and Technology).

FIGURE 1
A FOUR-STAGE S&OP PROCESS MATURITY MODEL

Stage 1 Marginal Process	Stage 2 Rudimentary Process	Stage 3 Classic Process	Stage 4 Ideal Process
Informal Meetings • Sporadic scheduling	**Formal meetings** • Routine schedule • Spotty attendance and participation	**Formal meetings** • 100% attendance and participation	**Event-driven meetings** • Scheduled when someone wants to consider a change or when a supply-demand imbalance is detected
Disjointed processes • Separate, disjoint demand plans • Supply plans not aligned to demand plans	**Interfaced processes** • Demand plans reconciled • Supply plans aligned to demand plans	**Integrated Processes** • Demand and supply plans jointly aligned • External collaboration with limited number of suppliers and customers	**Extended processes** • Demand and supply plans aligned internally and externally • External collaboration with most suppliers and customers
Minimal technology-enablement • Multitude of spreadsheets	**Standalone applications interfaced** • Stand-alone demand planning system • Standalone multi-facility APS system • Systems interfaced on a one-way basis	**Applications integrated** • Demand planning packages and supply planning apps. integrated • External information manually brought into the process	**Full set of integrated technologies** • An advanced S&OP workbench • External-facing collaborative software integrated to internal demand-supply planning systems

Table 2 – Maturity framework
Lapide 2005, p.14

Stage 1: Marginal Process

In this phase the meetings are sporadic, there is not a real schedule for the meetings, and the participants do not engage themselves actively in the process, the silo mentality is not changed. The processes at this stage are separate, both sales and operations functions draw their own independent forecasts and do not cross information, there is little or none consolidation attempts. Regarding IT, there is little integration software in place - each function has its own spreadsheets.

Stage 2: Rudimentary Process

A Stage 2 company has a formal planning process in place, however level commitment of the participants is still not optimal - some do not attend or do not actively try to come up with a joint plan. At this stage the processes are interfaced, both sales and operations plans are done separately in a sequential way, with operations plotting their plans in accordance to the sales forecast. Regarding IT, both sales and operations have their own separate dedicated software. Although information is transmittable between these two types of software, it cannot be used in real-time.

Stage 3: Classic Process

A company with a Stage 3 process have a formal S&OP process that follows most of the guideline presented by Larry Lapide in the first part of his Sales and Operations Planning series. In others words, there is a schedule for all the meetings, the meetings are held and attended among highly ranks cross-functional participants with the goal of matching the supply plans with the demand plans. The planning in this stage is integrated, the sales come up with a draft of their forecasted demand, then operations gets this draft and with it drafts its own supply forecast draft, after both drafts are done they (both forecasts, not only operations) are discussed in the S&OP meeting and adjusted by the cross-functional team attending.

In the later part of this stage it is possible to include in this meetings some of the principal costumers or suppliers of the company in order to help in providing more reliable forecasts. Regarding IT paremeter, at this point both the sales and the operations software are integrated to allow the final plan to be drafted jointly.

Stage 4: Ideal Process

This stage, according to the author, cannot be achieved since it requires a perfect alignment between sales and operations and a IT support programme capable of shifting its plans according to real-time information. However, it can be used as a target, a role model to continuously improve the process. The process at this stage should follow all of the sets explained in the first part of Lapide´s “Sales and Operations Planning” series. The meetings are event-driven, taking place only if some change need to be implemented or if supply and demand are unsynchronized, this implies that there is a system in place the allows the supply and demand to be motorized in real-time. At this stage the whole process is perfectly aligned internally with all of the functions plans reacting to each other, and is extended externally with most of the clients and suppliers giving input and influencing the plans of each function. In an IT stand point, an advanced S&OP Workbench would need to be used, to enable global access and a real-time modification of supply and demand. Furthermore this workbench would recommend the changes that need to be implemented to achieve the new optimal point in the supply-demand parity.

3.3 Models Analysis

When analysing both models, it is evident some communalities. This was expected since Grimson & Pyke based partially their academic model in Lapide´s practitioner model. Some of the dimensions used to evaluate the maturity of a S&OP process are common and both models aim to achieve a unreachable maturity level. However it is also evident that through their research and methodical approach they were able to develop further Lapide´s model and came up with more complete model.

The approach used by Lapide to develop his model was of a practitioner. Larry Lapide tapped into his experience to develop this model, instead of an academic and systematic approach to the development of his model. The consequence of such an approach is that his model is easy to understand and easily applied to real companies. Especially if the other two parts of his “Sales and Operations Planning” series are used as the theoretical support, to the practical application of this model. Furthermore in his paper Lapide also provides some practical guidelines to develop a S&OP model through his different levels of maturity.

Grimson and Pyke in their turn adopted a more systematic approach in the development of their model. A thorough analysis of literature was made and 15 in-depth company interviews were done, encompassing in this way in their model both theoretical knowledge and practical experience. Furthermore to develop their model two other models were used as a reference the six staged Aberdeen Group´s S&OP competitive framework and the Lapide´s *"Four-Stage S&OP Process Maturity Model"* used in this paper as well. From this research a more complete and complex model arose that allows an in-depth analysis of the S&OP process maturity in the company.

When comparing both of the main difference, apart from the degree of complexity of the models, is that Lapide´s model does not include in its assessment one essential dimension, that Grimson and Pyke´s model includes.
When comparing the dimensions used by both models to assess the maturity of the S&OP process they are for the most part equivalent. Grimson & Pyke´s "Information Technology" and "S&OP Plan Integration" are similar to Lapide´s "Technology" and "Process" respectively. It is even possible to infer that Grimson & Pyke´s "Meetings& Collaboration" and "Organization" dimensions altouhgh broader encompass fully Lapide´s "Meetings". However the "Measurements" parameter in the Grimson& Pyke model does not have a correspondent in the Lapide´s model. This parameter is essential when managing successfully the a Sales and Operations Planning process, since its with this through this type of measurements that the process evolves and improves. Additionally, to develop an advance set measurements take a lot of effort and a deep knowledge of the whole S&OP process. Therefore it is relevant when assessing the maturity level of a S&OP process to evaluate this dimension since it will influence both the development of the tool and it is a mirror of the knowledge the company has in this S&OP process.

Chapter 4, Design and Implementation of a S&OP in a multinational company

In this chapter a full description of the actual process of design and implementation of Sales and Implementation process in the multinational company is present. Furthermore, also during this chapter there will be three theoretical evaluations of the maturity of the S&OP process.

4.1 Introduction - Strategy shift

Since the new Executive Vice-President (EVP) assumed his position in May 2012 the company has taken a turn in its strategic direction, unity and cooperation substituted independency and technology specialization as the main strategic words driving the company.

Historically the company´s Business Units (BUs) worked almost independently within its areas of operation. Although some actions to change this mentality were taken previously, the company´s BUs still worked as small independent entities by the summer of 2012. Under the new leadership a set of wide range actions were taken and a new organizational structure was implemented to push the 5 BUs to work together as a company.
One of the central points of the new EVP approximation strategies was to implement a joint Sales and Operations Planning process (S&OP). The results of this process would give the management team the necessary insight to align cross-functionally the strategic goals of the company and set accurate corrective actions for each BU to achieve a greater efficiency in resource use, while assuring a high quality delivery. The objective of the S&OP tool was to achieve an operational improvement (Thomé, Scavarda, Fernandez and Scavarda 2012). This improvement would be achieved by making the necessary resources for each project available in time and to promote resource exchange and cooperation activities that will help each BU to capitalise on the group´s advantages instead of fighting on its own. The resources in this case are the engineers that take part in the company’s projects. In a more practical and simplistic approach, the objective of the S&OP process is to provide management the necessary information for management

allocate the correct amount engineers with the appropriate skills in the different BUs in order to optimize the company´s profit.

Although the discussion surrounding the S&OP was finalized and the green light on the in-house development of such tool was given, the decision did not generate a consensus. There were still some parts of the organization that did not see the benefits of such a tool.

4.2 Designing the Sales and Operations Planning Process

"I do not know how much I am going to sell next year or if I have the necessary resources to produce what I am going to sell" New EVP

The task at hand was to develop and implement a global S&OP tool, which could be quickly spread throughout the company and put to use in a timely manner.

In this practical approach the S&OP tool stands for a sequential process that will in a first stage define and push the production of uniform sales forecasts from every BU and in a second stage define and push the production of uniform operations plans based on the respective sales forecast. Being the whole process based in a centrally defined Excel IT tool.

The development of this tool was, in an initial stage, the result of a joint effort between Business Development (Sales) team and the Operations team. However after the initial research, the Sales team became responsible for the development of the sales part of the S&OP tool and the Operations team became responsible for the development of the Operations part of the S&OP tool. This paper will be focused on the first stage in both parts of the tool. In the second stage, after the split between Sales Planning and Operations Planning, it will mainly be focused in the Operational Planning process development and implementation, tapping into the Sales Planning tool´s history only to justify or explain events in the operational side.

4.2.1 Assessing the initial situation

Before developing the tool in itself it was imperative to understand the degree of maturity the company had on this theme. This line of action goes in line with the approach defended in some of literature on this subject (Lapide 2005). To get this knowledge an internal research was conducted. The main questions that this research needed to answer were:

1. How is activity planning seen and done within the company?
2. Does activity planning occur within each BU or is it a group effort?
3. Are there already any S&OP tools or similar initiatives in place, even if working only in a regional level?

To gather this information multiple sources were used. Regional and global databases were analysed and multiple engineers and managers were consulted. When possible, one-on-one contact methods like interviews or phone calls were used, however due to time and geographic limitations most of the research was done via email.

When using the S&OP process the objective, from an operational point of view, is to match supply and demand by assessing the capacity of each BU and matching it to the demand from the market (Grimson and Pyke 2007). In other words the objective is to find the most profitable match between the amount of engineers/ capacity and the amount of monthly project-related task for the next 12 months.

The whole process takes place at capacity planning level and does not encompass the resource management level. The relevant difference between this two concepts is that while capacity planning strives to make available the amount of resources necessary for the tasks at hand during the analysis timespan, recourse management strives to define what task each resources should execute in the analysis timespan.

The objective was not to determine what task each engineer should do each month, that is resource management and it falls outside of the S&OP objectives defined by company. Additionally is also relevant to mention that this tool will only consider working hours that can be attributed to a project, the further business development work or "overhead" will not be considered in the S&OP tool.

With the previous principles in mind the results of the internal research were:

1. **How is activity planning seen and done within the company?**

   Although some level of planning was done, the general perception was that planning was a difficult task in the Oil and Gas industry. Efforts were focused in reacting quickly to changes instead of predicting them. Each BU would focus on planning for the work they are executing or that they are almost certain that they will execute in a very short period of time. Only marginal efforts were made to get ready for possible work to be won in the future.

"(...) have you seen the crystal ball we have in the entrance of the build? Have you seen the holes in it? So that is how we see our future. It isn't easy to fill those holes." Project Manager

"It is easy to tell us to plan better. But reality is different (...)"
Operations responsible

   The information gathered pointed that planning was not a totally cross-functional exercise within each BUs and tended to focus in a more resource management approach than in a capacity planning approach. Furthermore during this internal research the first major problem was unveiled, each BUs used its own metrics (hours, activities, etc) and timespan when planning. This made any attempt to aggregate and cross the available information futile.

2. **Does activity planning occur within each BU or is it a group effort?**

   The data collected indicated that although a joint strategy was already defined by management. In general each BU did its own planning independently and each BU´s functions operated individually. This type of behaviour was the results of the silo mentally advocated by the BUs. Such a mentality type of mentally does not accommodate initiatives such as S&OP where cooperation and cross-functional integration of plans is essential. This independent way of thinking and planning might have its roots in company policy, structural organization or misalignment of incentives (Oliva and Watson 2009, Shapiro 1977).

Previously each BU was evaluated individually an on the amount of business executed. This evaluation system might have lead to a misalignment of incentives, since BUs were indirectly pushed to not help each other since this would ultimately use up some of their resources in something that does not contribute directly to the increase of the amount of business executed.

With the new management team this evaluation method changed and some conjoint strategic initiatives like cross BU support for specific projects seemed to be starting to take their first steps, however making such a big cultural change is not a fast process. (Oliva and Watson 2009, Shapiro 1977)

3. **Are there already any S&OP processes or similar initiatives in place, even if working only in a regional level?**

From the data retrieved, no formal mature S&OP process was identified in any of the BUs. Nevertheless every BU had its own (and distinct) resource management IT tool and process. This fact only increased the complexity of the problem previously identified. Not only each BU uses different metrics and timespan during their planning but also uses different IT tools and processes to do their planning.

Furthermore, an essential discovery was made. In one of the multiple meetings hold to discuss the S&OP planning it was found in the one of the BUs an excel-based tool that was used to plan the operational activity at a capacity level according to the BU´s sales forecast. Although still far from the final objective it showed some of the required features for an initial stage S&OP tool. It was decided at that point that this tool would be used as a starting point for the development and implementation of the S&OP process. Three pictures of this tool can be found in **Annex 1**.

After the initial assessment of the company regarding S&OP performance and processes, the management team decided that the better way to develop such process was to separate the S&OP process into two distinct processes each one with a dedicated team that would be developed in parallel. One of the teams would be responsible for the Sales Planning Part and would be under the Business

Development Function and the other team would be in charge of the Operations Planning and would be under the Project Execution Function.

Maturity Evaluation – First Evaluation

Throughout the paper two maturity models will be used to evaluate the maturity of the S&OP process in the company. The objective of this exercise is to measure the evolution of the system throughout its implementation. This first evaluation intends to assess the maturity level of the initial S&OP process, prior to the work done by both Sales and Operations Planning teams.

Grimson and Pyke Model

Parameter	Comments	Stage
Meetings & Collaboration	A silo culture is in place, there aren´t any S&OP meetings, collaboration is still scarce	**Stage 1**
Organization	No S&OP organization in place	**Stage 1**
Measurements	No measurements in place to evaluate sales and operations besides the basic financial indexes	**Stage 1**
Information Technology	Independent spreadsheets, no consolidation work done	**Stage 1**
S&OP Plan Integration	No formal planning process, operations attempts to meet incoming orders	**Stage 1**

Table 3 – Grimson and Pyke Evaluation 1

According to the Grimson and Pyke Model the company is still in Stage 1 of the S&OP maturity process.

Lapide Model

Parameter	Comments	Stage
Meetings	Sporadic meetings	**Stage 1**
Process	The process is still disjoint, supply and demand are no aligned	**Stage 1**
Technology	Besides the rudimentary tool fond in NCS, no other spreadsheets could be fond.	**Stage 0,5**

Table 4 – Lapide Evaluation 1

When using Lapide´s model the results achieved are similar, the company is in initial stage of maturity of the S&OP process. In the "Technology" parameter the company is even before the Stage 1, since in some of the BUs no formal capacity planning IT tool was being used.

4.2.2 Building the Operations Planning tool

Predefined features and preliminary findings

While the initial research was being done, there were some attempts to develop an Operations Planning (OP) tool. The objective of the OP tool is to develop uniform and complete operational plans, which can be consolidated at a global level.
This was done since some of the future characteristics of this tool were already defined:

<u>Meeting frequency</u>

The whole S&OP process should occur every six weeks in an initial stage and after it matures the objective would be to reduce the time between S&OP round to four weeks. Two meetings would work as checkpoints in the S&OP process. The first the Sales meeting where sales personnel will define the BU´s sales forecast for the next 12 months, without any operations function input. A second meeting where operations personnel will draft the BUs operational plans based in the sales forecast produced in the first meeting.

Time Frame and spreading capability

To match the urgent time frame and spreading capability, this tool had to be used by all the BUs, required in this task the IT tool to be used as the base for the S&OP tool was predefined as Excel.

Excel was chosen as the support IT tool for this process because it is already used by every BU. Saving in this way the implementation time and compatibility issues, which is a relevant issue since some of the other tools available in the market can have implementation times of over a year. Additional with Excel is easy and quick to produce and change the type of templates needed for the S&OP process. This feature reduces drastically the time between prototypes, shortening in this way the whole trail-and-error process allowing a quicker implementation. However Excel was not designed to do this type of work, raising some questions regarding its compiling and graphic display capabilities in a more advanced stage.

Forecast Timespan

The forecast's timespan was also pre-research defined as 12 months. This forecast length is considered to be ideal in the trade-off between forecast accuracy and business relevant information.

Display characteristics

Another pre-defined characteristic was that the S&OP tool needed to display, in a graphic way, the discrepancies between available capacity in each BU at each moment, and the requested capacity generated by the sales forecast of each BU. This was an essential characteristic in order to visually see if the match between the sales forecast and the operational capacity.

Process definition

The criteria used to define which projects/prospects to include in the OP tool was the last predefined feature. All the projects that are already booked and the "prospects that will most likely be won" should be accounted for in the tool and therefore efforts should be done to gather resources to execute them. This predefined feature was the base for the sales function to produce their sales forecast. However the definition of "prospects which will most likely be won" goes beyond quantitative measures and has a bit of "gut" feeling in it, therefore although some quantitative measures were in place the GO (likelihood of a project going forward) and the GET (likelihood of Aker Solutions Process Systems winning the project) the final decision of what prospects are consider “prospects which will most likely be won” or not has to be done by the people working closely with the clients in this case the Sales Managers/BD Responsible in each region.

These first attempts to develop an Operational Planning tool stumbled in one of finding of the posterior research, the BUs used different metrics to measure work. Some focused in the amount of tasks needed to complete a job while others focused in the working hours needed. Additionally, these initial attempts also unveiled another discrepancy between BUs we can call it the third main problem**,** a project plan is divided in a set of disciplines under which activities or hours are accounted for. These disciplines can be seen as the recipe for the project and they include engineering disciplines like “Process engineering” or “Piping”, support disciplines such as “Doc Control” or “Cost” and Management disciplines for instance “Project Manager”. The problem was that each BU had its own set of disciplines and its own definition of what activities should be encompass under each discipline. The consequence of this problem was that the operations plans of each BU were done based in different set of rule and therefore not crossable. Furthermore due to this different set of disciplines and not crossable information done by the BUs, the Operations function can only assess both requested and available capacity locally. The function can not have a global vision of the capacity in the company.

In order to successfully mirror the capacity needs of the projects and to fulfil efficiently this needs, the Operations Planning tool had to have its own set of disciplines. This set of disciplines had to be universal and compatible with the specific set of disciplines used by each BU and would allow the consolidation of the several Operational plans.

The definition of this set of disciplines for the OP tool was the reason for the failure of these first attempts to develop a functional OP tool. The process used to define these disciplines did not give the expect results. The Operation team tried to start with one BU list of disciplines and then adapt it to a different BU by including extra disciplines when needed or including new definitions under each existing discipline. This resulted in long lists of disciplines with disciplines that only one BU used and disciplines with a too broad of a definition causing overlaps with other disciplines, not allowing the Operation team to have a clear picture of capacity utilization or needs. Bottom line this bottom-up approach from BU to Operation team, did not produce any useful set of disciplines.

4.2.3 Building the Operational Planning tool – post-research approach

With all the knowledge gathered from the research and the preliminary attempts some further decisions were made.

Since the Bottom-up approach used in the Set of Disciplines did not pay off, a new approach was used. The tool found in one of the BUs during the preliminary research was fully adopted and the it´s set disciplines used as the basis for the new set of disciplines. As mentioned previously, this tool filled a lot of the requirements already defined for the OP tool, it was Excel based, it was adaptable to a 12 month timespan and it had a complete graphic way to present the resources available and resources required. The objective would be to adopt a top down approach, now the OP team would define the set of fixed discipline and push it down, forcing the BUs to comply. This approach although more disruptive to business in the short term, since all the BUs would have to change their own planning process, would in the long-run solve the set of disciplines problem and allow the OP team to have a greater understanding and control of the set of disciplines since they were the responsible for defining it.

Although this tool was been used successfully in this specific BU it did not encompass all of the aspects that an S&OP tool should, therefore it had to be adapted and completed in order to be successfully deployed in the other BUs.

In order to make the tool found appropriated to the S&OP process the following changes were done:

- Uniform and accurate operational plans – The set of disciplines present on the tool was updated and completed by the OP team in order to enable the BUs that will use the tool to produce a uniform and accurate set of operations plans. Furthermore it was essential to define a uniform metric to assess the amount of work under each discipline. As mentioned before, each BU at this point used different ways to measure work, some did it in hours other in activities. To solve this problem the OP team selected a metric that should be adopted and used by every BU. The selected metric to be use in the Operations Planning Tool was *"Full Time Equivalents"* (FTE). This choice was made based on two important reasons, the first one was that this measuring method is a good operational fit for the tool since it bypasses problems like different number of hours worked per month (in Brazil the work month has 176 hours, while in Norway it is around 150). The second reason is of a more political nature. Since every BU had its own different metric system, choosing one of the already in use metrics will seem that the OP team favours one of the BUs. So by choosing FTE, that no one used, this problem is avoided. This decision aimed to solve the second big problem identified, since now the metric used was common to every BU.

- Adapt the tool to the Sales forecast principles – In order to be able to use the Sales forecast as a base for the operational plans it was necessary to change some of the notations used in the tool. The original template used *"Budgeted Projects"* as the projects to be inserted in the tool. This notation was substituted by *"Priority Prospects"* since *"Budgeted Projects"* stand for projects included in the annual budget, not accounting for sales forecast updates such as new projects and shifts on GET and GO. With the new ***"Priority Prospects"*** all of the prospects, which will most likely be won, are included. The goal of this change was to strengthen the link between the sales forecast and the operations plans, by pushing the operations side to start gathering resources for projects that are likely to be own, even if not included in the budget.

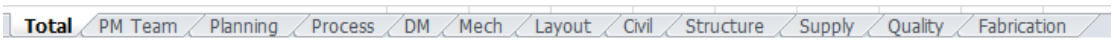

Figure 4 – New Set of disciplines

After upgrading the tool it was also crucial to develop other complementary sub-tools, since the Operations Planning only covered the BU´s needs of resources and resources capacity. With the Operations Planning tool as a base the Operations team develop a Project focused sub-tool called *"Project Plan Template"*. This sub-tool would allow each BU to assess the capacity needs of a individual project according to the S&OP principles and simplify the population of the Operations Planning tool. Additionally a group-focused sub-tool called *"PRS Resource Plan"* was also developed. Its objective was to consolidate all of the BUs OP tools, this consolidated template would allow the management team to have an overview of capacity required and capacity available globally and to which extent is operations plans matching the sales forecast at a global level.

With the tool in place the Operation team felt it was safe to “push” down to the BU and start implementation. The following presentation was also attached to email sent to the BUs. The objective of this presentation was to explain how to use the tool and to make clearer the objective of the all S&OP exercise

4.3 Implementation of the Operations Planning tool

A successful implementation of the S&OP process, according to the literature, is three-folded. Business culture needs to change since, now every function and every BU need to work together. Business processes needs to change, the way of doing things needs to change to accommodate the S&OP cross-functional planning and the reporting methods. Finally the IT support tool needs to be adapted and put into use (Lapide 2005, Grimson and Pyke 2007, Oliva and Watson 2009, Shapiro 1977). In this practical case, the implementation process followed to a great extent the theories studied. In order to evaluate the success of the implementation the S&OP team defined four practical dimensions (described below). In a posterior analysis it is possible to see that these four dimensions used in this practical case can be associated to the three dimensions used in the studied theoretical papers.

- **Correct Sales forecast** –To be successful, each BU has to be able to include in their Sales forecast, all of the projects they should be planning for with the correct starting date. The BU´s sales representative in the Sales Planning Meeting should transfer this information to the Operations Planning Team. This dimension can be linked to both Business Process and IT theoretical implementation dimensions, since it is a process-defining dimension and it assumes IT capabilities that will allow the execution of such a task.

- **Correct Operational Capacity** –To be successful, each BU has to be able to understand how much capacity they have available at each moment In the case of this company the capacity is the number and skills of its engineers. This can be achieved by linking their resource management IT tool with the Operations Planning tool. This dimension can be linked to both Business Process and IT theoretical implementation dimensions, since it is a process-defining dimension and it assumes an IT capability that will allow the execution of such a task.

- **Match Sales and Operations** – Each BU has to understand how many and with which skills people each project in the sales forecast requires. This can be achieved by transferring the information from the Tendering Schedule (activities timeline in the Tendering phase) or the Execution Plan (activities timeline in the Execution phase) to the Operations Planning Tool. Again this dimension can be linked to the Business Process and IT dimensions, for the same reasons presented before, it defines a way to do the process in itself and it assumes that the IT tool has to be in place and be able to provide this type of services.

- **Motivation and commitment** – Each BU has to participate actively in the process and try to achieve the better result possible in each of the tasks in the process, only in this way the information provided is reliable. When assessing this dimension in a theoretical point of view, it is comparable with the Business Culture dimension defended by theory. To maintain motivation and commitment to this process it is necessary to shift the culture in the company, it is necessary to make employees believe that this process has benefits.

During the implementation of the tool there was the need of a lot of clarifications since the set of disciplines used by the OP team differed from all the ones used in the BUs in their planning at that time. Additionally not all of the BUs seemed to support this exercise, so while some BUs spammed the Operations Team mailbox with the questions other did not even answer the emails sent. This discrepancy in interest in the S&OP process could be a result of a flawed implementation stage. The necessary changes in the business culture might not have been achieved successfully. This resistance to the new business culture might come from a strong believe in the current local planning procedures or the

OP Team inability to explain the benefit of the process. Additionally one of the non-complying had a complex organizational structure, a multidisciplinary team and smaller easier to plan projects making the implementation and population of the S&OP process a harder task than in other BUs with simpler structures. This is so for two reasons, in such a multidisciplinary BU defining the operational capacity is not a straightforward task since everyone does everything, making the available capacity not clear. Furthermore in this smaller BU cross-functional planning occurs informally since most of the times there are so few people involved, with the S&OP tool all of this informal communication would have to became more formal and therefore increase the amount of work necessary to complete them.

At this point according to the information gathered in the latest preliminary S&OP meeting was that 3 out 5 BU were actively trying to implementing the tool and 3 out of 5 appointed in some way an internal responsible for the tool and were able to produce some results.

4.4 The first S&OP round of meetings

The meeting was structured as a two- full day meetings, in the first day all of the Sales function would gather and define the list of projects each BU is planning for (sales forecast), and then one week after the Operations function would gather and discuss the actions that should be undertaken to align the operational capacity to the sales forecast.

4.4.1 Sales Planning meeting

The goal of this meeting is to define a sales forecast for the following 12 months of activity, this forecast will be used by the Operations function to plan their activities, furthermore it is also part of the agenda of this meeting to set actions to increase sales.
The set up of the meeting was the Sales people of each BU would get together with the Sales Planning team in their specific time slots, and define the list of projects each BU is planning for (sales forecast), furthermore a representative of the Operations Planning team would present throughout all of the time-slots to gather information to ensure an easer transmission to operations of the sales forecast.

The main goal of this first Sales Planning meeting was to ensure that the S&OP process was implemented correctly and define the type of input each BU should contribute with. Every BU was able to define some type of sales forecast, however the quality and format of this forecast was still not uniform or at the level requested.

4.4.2 Operational Planning meeting

Time slots and attendees

The first Operations Planning meeting took place, as scheduled, one week after the Sales Planning meeting. The goal of this meeting was to define the most efficient use of each BUs capacity when satisfying the sales forecast. In other word match the supply to the demand. In the case of the Operations Planning meeting the set of attendees was not as clear as for it´s sales counterpart. Attending all of the time slots of this meeting were the Operations Planning team, plus some global functional representatives from Supply-chain, Quality and Finance. Attending only their time slots were the employees accountable for the Operations Planning tool in each BU. Although an Operations related person would be preferred to assume this position, it was not predefined the organizational position of the employees in charge of the Operational Planning tool, therefore each BU selected the person they understood to be the most appropriate to represent them in these meetings.

Example of an Operations Planning Meeting timeslots and participants

08:30-09:30 – BU1# – VP of fabrication, Managing Director for AP, Operations Director

09:30-10:30 – BU2# – VP of Operations

10:30-12:00 – BU3# – Managing Director, Head of Tender Management, Responsible for Tendering & Execution

13:00-14:00 BU#4 – Managing Director for

15.30-16.30 – BU#5 – Operations Manager

Global function participants (attending all the timeslots) – President of Operations Global, Supply Chain Manager and VP of Engineering, Operations Planning Team

The meeting

In the meeting the Operations Team received a populated Operations Tool from 3 out of the 5 BUs, the two remaining BUs were not able to deliver a relevant input. These different degrees of contributed to the S&OP process could be the result of the flaw in business culture implementation process. The two non-conforming BUs expressed some concerns regarding the objective and utility of this exercise since they had their own planning process.

The discussion during the meeting was focused mainly on input quality issues since this was the first time this type of capacity planning was done. Furthermore, a lot of the Operations Planning team efforts were focused in re-explaining the objective and goals of the S&OP to maintain or achieve higher levels of motivation in the people evolved and hopefully achieve a solid business culture change. All the BUs had doubts on how to populate the templates and suggestions about the discipline list.

Nevertheless with the input received it was possible to compile partially the stage 3 template *"PRS Resource Plan"*, and have a general picture of the capacity on the whole company. It the Annexe 3 it is possible to see an image of this PRS Reource Plan

Conclusions – action list

In this meeting a set of actions were put in place to increase the quality of the input and to enhance the performance of the tool, as said previously the focus was not on the analysis of the results. Some of the actions were placed in the global function and other were BU specific.

The Operations Planning Team focused more in developing the tool and the process further. By including new disciplines or drop useless ones and "push" (setting specific actions) the non-complying BUs to start working on the process rather than analysing and setting capacity optimization related actions based on the input available. Two main premises supported this line of action. Firstly it was important for the credibility and usefulness of the process that every BU takes part on it. Since it is difficult to push one BU to do an extra effort to populate the tool when other BUs are not doing it, and to optimize the use of resources across PRS its essential to know the amount of resource present in all the BUs. The second reason delay implementation of corrective actions related to capacity utilization is that the level of accuracy of the input in general was not enough for the Operations Planning Team to set accurate actions.

Maturity Evaluation – Second Evaluation

This second evaluation will be focused in the period of time between the last evaluation, that occurred before any work related to S&OP was done and immediately after the first official S&OP meeting. During this period of time a first prototype of the S&OP tool and process were designed and implemented.

Grimson and Pyke Model

Parameter	Comments	Stage
Meetings & Collaboration	There is already a formal set of two meetings, done in a sequential way. The sales meeting to define sales forecast and the operations meeting to define the operational plans according to the sales forecast. In theses meetings other then senior managers are included and give their input, increasing the range of input and increasing the maturity stage to 2.5.	**Stage 2.5**
Organization	There is an official S&OP function. However it is not independent and organizationally it is included under Project Execution.	**Stage 3**
Measurements	No extra measurements in place	**Stage 1**
Information Technology	Independent spreadsheets, however some degree of consolidation is done centrally.	**Stage 2**
S&OP Plan Integration	Although the process to achieve a Stage 2 S&OP Plan integration is in place, it is still no put to practice in an effective way.	**Stage 1**

Table 5 – Grimson and Pyke Evaluation 2

When comparing the results achieved in the first Evaluation with the ones obtained in the second it is clear that the tool evolved in several dimensions. This evolution was felt especially in the "*Meetings & Collaboration*" and *"Organization"* parameters. The evolution in these dimensions is only management driven since these parameters are relates to the organizational structure of the company. Regarding the *"Measurements"* dimension no evolutions was noticed, since no efforts were done to develop a set of measurements to evaluate the performance of the process. In the remaining parameters there is still a lot of work to be done and it is expected that the results will take more time to show up since they are linked with the execution of the process. Which takes time to be learned and executed.

Lapide Model

Parameter	Comments	Stage
Meetings	There is a routine in place, however to the lack of participations of some of the people attending the meeting it is not possible to categorize it as Stage 3.	**Stage 2**
Process	The processes necessary to achieve the alignment of supply and demand are in place however not all of the BUs are taking part on the process and the ones that are did not at this point achieve any relevant results.	**Stage 1.5**
Technology	The process in place goes beyond the simple spreadsheets, since there is some consolidation. However no other standalone software is in place in either Sales or Operations function.	**Stage 1.5**

Table 6 – Lapide Evaluation 2

According to Lapide´s Model the S&OP process evolved marginally in all of the parameter. However most of the features necessary to evolve the *"Meetings"* and *"Process"* to the next level are already in place, but not yet been used.

4.4.3What was learned evolution of the tool

Beside all the actions taken during the meeting to improve the set of disciplines and the tool in itself, it was possible for the Operations Planning team, to withdraw some extra conclusions, which will guide the next steps of the development and implementation of this tool. It was clear now that to change the business culture and make everyone comply it was necessary to increase the level of formality in the process, to state the importance top management was giving to this project. Additionally it was also the Operations Planning team understanding that making the process as transparent as possible allowing the BUs to easily understand the added value of the process would help them to change their mind-set and motivated them to be a part of it.

4.4.4 Flowchart

One of the decisions made after the meeting was that a flowchart showing the whole S&OP process should be drafted, uploaded into the S&OP Enet page (companies internal internet) and made available to everyone involved in the process. The objective of this decision was firstly to increase the transparency of the whole process and make its benefits evident, since the players involved in the Sales part were in many cases not in the Operations part. Secondly to increase the formality of the process by showing the whole organization that this process had a defined set of steps that should be followed. In other words this was an initiative to change the business mentally of the company. An image of the Flowchart might be seen in Annex 3.

4.4.5 Changes in disciplines and increasing the level of detail

Actions on the Global Function

One of the actions from the meeting was to increase the level of detail in the input given from each region. The reason behind this action is that in order to make accurate capacity-optimization decisions top management felt that the breakdown of the projects (set of disciplines) was not thorough enough. The practical result of this action was that the OP team had to go back to the drawing room and reassess the set of disciplines and try to split them further.

The discussion aim was to achieve the optimal point in the trade-off between more detail and higher input quality. The more the set of disciplines was slip up the better the management team could place actions since there were more with a smaller range disciplines. However the more the set of disciplines is slip up the bigger is the amount of work needed to gather the necessary information to populate this set of disciplines. This extra work would make providing high quality and timely effective input a harder task for the BUs. This trade-off only exists because the IT tool that works as the base for the whole process is quite limited and most of the gathering of information and population of the tool is done manually. As stated by the tool models used to assess the maturity of the S&OP plan, it is only possible to achieve a high level of maturity and harvest the full range of benefits of this process with adequate, dedicated software (Lapide 2005; Grimson & Pyke 2008).

The result of this discussion was a new and larger set of disciplines. Furthermore the information gathered during the meeting showed that the definition of each discipline was still not the same in all the BUs. This issue if not attended will result in miss alignments between in the capacity plan and reality. Therefore a more thorough list of definitions was also drafted.

All of these changes were incorporated in the tool. Plus, on the IT side of implementation, a new graphic display was also designed to increase the amount of information displayed allowing in this way a better understanding of the Required Capacity in each BU and in some BUs there was an effort to connect their resource management IT tools mentioned before to the Operations Planning tool in the hope of automatize the process and accurately identify their capacity characteristics and limits. An image of the new graphic display can be seen in Annex 3.

4.5 The second S&OP round of meetings

4.5.1 Set up the 2nd meeting

When redeploying the OP tool the Operations Planning team had to face two main challenges:

- Maintain Motivation – It was important to keep motivation since each BU had to restart the whole process again. It was essential to maintain all of the BUs on board with the S&OP process since the input necessary for the process in produced by the BUs. Furthermore it is also vital or the process to encompass the all of the resources the company has in order to give to management a complete picture of the companies operational plans.
- Maintain/increase Communication – The second challenge the OP team faced was to maintain and in some cases increase the communication between the OP team and BUs. To implement successfully the new tool, a great deal of communication between the OP team and the employee in charge of the tool in each BU needs to be done. There is the need for constant clarifications and small adjustments in the tool in order to make the process work. The challenge faced by the team was that not always this communication is easy to establish in an organizational setup like this. Different time fuses, lack of response or shifting responsibilities are only some of the obstacles the OP team had to face.

4.5.2 Results from the Sales Planning meeting

Like in the first round of meetings, an element of the Operations Planning team was present during the different time slots of the meeting. The objective was to ensure the correct communication between both parts of the S&OP process and, once the operations plans present a high level of quality, give some inputs to the sales forecast about capacity limitations. Increasing in this way the level of integration between the two functions plans. The sales part of the S&OP process was already working in efficient way. All BUs were able to develop again their own sales forecast, but this time using the S&OP

principles of “Booked Project” and “Priority Prospect” and some decisions regarding sales strategy were already made and actions were already placed.

4.5.3 Operations Planning meeting

Attending this second round of Operations planning meeting were approximately the same set of employees that took part in the first round, this was a positive indicator since this set of employees were already on board and updated about the whole process.

Meeting Results

In the meeting two actions regarding the OP tool and its process were placed on the Operations Planning team.

Increase communication

During the meeting the Operations Planning team realized that some of the projects included in some of the BUs operations planning tool, were not included in the sales forecast drawn in the previous Sales Planning meeting and vice versa. This conclusion arose from the crossing of the data gathered in the Sales Planning meeting by the Operations Planning team member and the data received and presented in the Operations Planning meeting by each BU. This miss communication jeopardizes the entire S&OP process, since the objective of this process is to align supply and demand is not achieved. Therefore an action was placed in the Operations Planning team to develop a file that would work as a transfer tool between the Sales part and the Operations part of the process, increasing communication and forcing the alignment between the two sets of plans.

Clarification of “Potential Revised Capacity” – The second action was regarding one of the concepts used in the tool, the concept of “Potential Revised Capacity”. This concept stands for the possible shifts in capacity during the timespan of the operational plan. This information was promptly included in the minutes of the meeting that would be distributed a couple of days after the meeting.

Operational Plans Validation

The majority of the BUs were able to deliver operational plans with a higher accuracy when compared to the last OP meeting. However this increase in quality was mainly related to the definition of the needed and available capacity within the BU, it did no influence greatly the o integration of plans between the Sales and the Operations function.

To achieve this increase in quality of their input these BUs started to hold internal meetings define accurate operational plans. One other factor that contributed for this improvement in quality was the fact that some of the BUs started to link their IT resource management tool with the Operations Planning tool decreasing the level of manual work needed to populate the OP tool.

There were also some BUs that were not able to deliver any useful operational plans. The BUs with which communication during the period of time that preceded the meeting was scarce were not able to implement the new tool or just did implement the process. To roots of this non-compliance were identified as lack of motivation and lack of communication. Therefore to solve them the OP team focused these meetings in motivating the BU and establish clearly the communication line by officialising a S&OP champion in each BU.

Lastly, it is also relevant to mention that in this meeting in one of the BUs there were already some discussions regarding resource exchange between BUs, due to a regional project overload. These were the first steps towards the implementation of resource optimizing actions. Although most of the discussions regarding this subject were done outside of the S&OP process ambit, this is a sign that the silo mentality the S&OP process struggled with is changing.

The "Increase communication" meeting

As a result of the action placed in the OP team a meeting was arranged with both teams involved in the S&OP process. During this meeting the bases for the transfer tool were defined. This tool should contain should be a list of all the "*Priority Prospects*" discussed during the SP meeting with a check list so it is clear which prospects should be planned for and consequently included in the operations plans and OP tool. Furthermore the member of the Operations Planning team that attends the Sales Planning (SP) meeting would be in charge of this transfer tool and it was established that every prospect discussion during the SP meeting should end with the question “Should we plan for this prospect or not?”. Finally the last step to officialise and inform the organization of this tool, the S&OP flowchart was updated and re-published.

Maturity Evaluation – Third Evaluation

Grimson and Pyke Model

Parameter	Comments	Stage
Meetings & Collaboration	At this point the set o meetings evolved. In order to delivery the requested input each BU holds pre-meetings within each function. Furthermore the discussion in the Operations Planning meeting is increasingly being focused in aligning operational and sales plans. However not all of the BUs are at this stage. Only BU2#, BU 3# and the BU5# can be evaluated as Stage 3. The remaining BUs are still lagging behind, since the discussion in their meeting is still on quality, driven by financial indexes and no pre-work seems to have been done.	**Stage 2.5/3**
Organization	There is an official S&OP function. However it is not independent and organizationally it is included under Project Execution. No changes since the last meeting.	**Stage 3**
Measurements	No extra measurements in place. No changes since the last meeting.	**Stage 1**
Information Technology	Independent spreadsheets, however some degree of consolidation is done centrally. Furthermore some of the BUs started to link to the process some extra resource management IT programs (operations planning software). Increasing the degree of automation.	**Stage 2.5**

S&OP Plan Integration	The majority of the BUs does follow at this point the process in place. In these cases sales drive the operations plan in a on-way process. Furthermore the is already in place an mechanism to achieve Stage 3 but it has not at this point been used.	**Stage 2**

Table 7 – Grimson and Pyke Evaluation 3

In an overall assessment, the S&OP process evolved marginally from the last evaluation. However when taking into consideration the short amount of time between this to evaluations, this evolution is quite positive. Regarding the *"Meetings and Collaboration"* parameter the evolution occurred just because the BUs started to follow the process, since the guidelines to achieve Stage 3 were already in place in the last evaluation. In the "Information Technology" parameter the most relevant change was the increase of automation in the process. Some of the BUs use, as preciously mentioned, a resource management IT tool. At this point this IT tool was linked to the S&OP process and used to help producing the Operations plans. Lastly regarding the "S&OP Plan Integration", most of the BUs now started to follow the process and started to integrate their functional plans. Furthermore it is of the intention of the S&OP team that the representative of the Operation Planning team attending the Sales Planning meeting starts to give some operational feedback about the capacity utilization, pushing in this way the parameter evaluation to Stage 3.

Lapide Model

Parameter	Comments	Stage
Meetings	There was an increase in evolvement by some of the BUs. BU2#, BU 3# and the BU5# are now at Stage 3. However the remaining Bus are still in Stage 2	**Stage 2/3**
Process	The processes necessary to achieve the alignment of supply and demand are in place however not all of the BUs are taking part on the process. Yet the BUs taking part of the process are already achieving some results.	**Stage 1,5/2**

Technology	The process in place goes beyond the simple spreadsheets, since there is some consolidation. At this point some of the BUs are starting to use some enabling software in the supply side of the process.	**Stage 1,5/2**

Table 8 – Lapide Evaluation 3

In Lapide's model the evolution of the tool is not as clear as in the Grimson & Pyke model. However once the remaining BUs commit to the process as much as the NCS, AM and EMEA office the overall evaluation of the maturity of the process will increase greatly. This is so because the main holdup to achieve the next stage in the parameter *"Meetings"* and *"Process"* is motivational.

4.6 The Current Situation

4.6.1 The S&OP tool

Regarding the set of disciplines, it is safe to say that it is close to it´s final form. The OP team believes that this set of discipline mirrors carefully the needs of a project and the present level of detail will allow top management to take correct and accurate corrective measures. Graphic display and updates, the presentation capabilities of Excel are being used at its fullest and there is a real necessity to improve this feature of the IT tool, however the present display already allows the tool to serve its purpose on a acceptable level.

Although the current S&OP process seems to have the necessary characteristics to fulfil the objectives set by management, when comparing the current S&OP process with theoretical models it is evident that the current S&OP process does not have the necessary features to achieve a high level of maturity in the maturity models we used to evaluate this process.

4.6.2 The tool implementation

To evaluate the level of implementation achieved at this point, the four point criteria defined as the essential characteristics of a successful implementation will be re-evaluated:

Correct Sales Forecast – All of the five BUs are able to produce their own sales forecast according to the S&OP process rules. It can be said that on this point the implementation is a success. However there is not a set of assessment principles to measure the accuracy of this forecasts, but this is a failure of this S&OP process in itself not a shortcoming of the implementation. Since none of this type of controls were defined by management when defining the process.

Correct Operational Capacity – In this parameter of the implementation process the level of success is not as homogenies as in the previous parameter. Only two of the BUs are able to understand their current capacity and its availability in a formal S&OP way, the remaining BU do have an a general idea of their capacity but are not able to translate into to the Operations Planning tool in an accurate way. This discrepancy exists because the two BUs that are succeeding at this parameter have linked their IT resource management tool to the Operations Planning tool, allowing a transfer of information in a more accurate and automated way.

Match Sales and Operations – Although the quality of the input used is in same cases not the best, generally the BUs have been able to successfully match their sales forecast with their operations planning, however since the whole S&OP process is so recent, is still necessary to wait for the next rounds of the process to evaluate in empirically if the matching is been done in a proper way.

Motivation and Commitment – In this final chapter of the implementation the results are once again varied. Most of the BUs seemed to changed their mentality and embraced this new way of think maintaining high levels of motivation and commitment. The remaining BU still did not have opportunity to display its new gained motivation, since the last meeting. Although all the results seem to be positive and the incentives in place push for a S&OP favourable alignment the process is still in its first steps, is still early to assume a total business culture change occurred.

At this point, is accurate to say that most of the BUs have successfully implemented the S&OP tool. Although there are differences in the level of implementation within this group it is reasonable to say that all of these BUs have a high comprehension of the whole S&OP process and have the ability to both develop a Sales forecast and to populate the OP tool with an acceptable quality level. The remaining BUs are also able to produce a Sales forecast however they do not possess the necessary insight to produce a operations plan according to this specific S&OP process rules.

4.6.3 Next Steps for the S&OP process: Practical approach

In the following section some possible next steps for the S&OP tool will be explained. These are the some of the possible practical initiatives the OP team in considering implementing in the company in the following months.

Measurement of the Process

Although the process in itself is defined and to some extent implemented it is necessary to develop a set of measurements to evaluate the performance of the process over time. The main objective of this evaluation is to enable the S&OP to learn from its mistakes and improve over time (Lapide 2004a). This type of measurement should be focused mainly in forecast accuracy, however other metrics might be useful, in this case a operational efficiency related metric would be desirable.

Develop a control mechanism for the Operations Planning

So far the lion cut of the discussion during the OP meeting as being focused on the quality of the input and in improving the features of the OP planning tool. However some decisions regarding aligning sales and operations planning and resource optimization are starting to be made. So far to address these operations planning decisions the Operations Planning team has been using common sense based on the vast experience of its own members. Up to now this type of approach as proven to be enough to address the scarce operations planning issues address in the meetings. Nevertheless with the evolution of the tool and the subsequent increase of complexity in the operations planning issues this approach is bound to fail. As it is mentioned in some of theoretical papers used in the literature review, it will be necessary to put in place a set of measurements that not only regulates the decision making process by defining when to act or not and legitimates the decisions of the team by using a firm set of rational rules bypassing this way the limitations of common sense but also measures the results of the actions put in place through time and therefore the quality of the tool.

This mechanism should be constituted of a set of rules and parameters that allow the Operations Planning team to evaluate each discipline in the OP tool in an objective and impartial way and identify clearly if an action is needed or if the degree of mismatch between requested capacity and capacity available is not addressable. In order to be efficient this set of parameters needs to be BU dependent and Discipline specific, since the disciplines have different importance for the project and the BUs act in different economic and legal environments.

The first steps to design this mechanism are now being taken. There is already, although primitive and still not discipline specific, a set of rules to evaluate the performance of a discipline.

1º step – the Buffer zone

When accessing a discipline, the focus should be in the Actual Capacity line. Taking that line as a base two imaginary parallel lines (below in yellow) should be drawn with respectively +20% and -20% of the Available Capacity line's Actual Capacity Total.

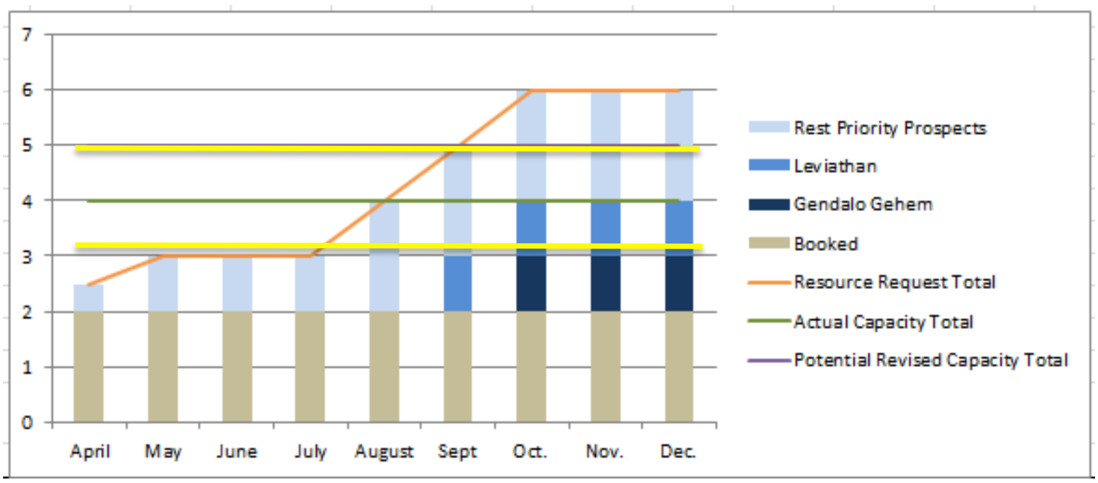

Figure 5- Control Mechanism buffer zone

Between these two yellow lines is the buffer zone, any variation of Resource Request between this two lines is considered acceptable and therefore no action is needed.
To fundament the spread of the buffer zone the OP Team collected some opinions from team leaders. The objective was to understand how much is reasonable to push a team to do extra time (upper limit) before having to ask for extra man-power to avoid delays and how much is reasonable to have "waiting time" (non-project attributed work time) before loaning this resource to other projects or BUs. The general feeling was that a ±20% buffer was reasonable.

2º step – The evaluation scale
After establishing the right and wrong criteria it is necessary to define a scale to see how many out-of-the-buffer months is acceptable during the 12 months analysis. To address this matter a 3 level grade system was defined.

Good – If there is no month with a Resource Request outside the buffer zone. No action is necessary
Average – If there is 1 or 2 months outside the buffer zone. Two months were seen as the maximum amount of time to push your team for an extra afford, furthermore it is difficult to justify economically the endeavour of acquiring or transferring and integrating new resources for such a short notice. Action in this case is discussable. This type of case should be analysed individually.
Bad – if there is more then 2-months outside the buffer zone. A 3-month time span is to long of a period to push your team to work extra time, and on the other hand it is a long enough period to make economically and operationally efficient integration of transferred or new resources. Action is needed urgently in this case.

New IT program for the S&OP process

The second suggestion is to change the IT program that is used as a base for this whole S&OP process. As explained previously Excel was the correct choice in an initial stage, the Operations Planning Team capitalized greatly on the transferability and simplicity of the program.

Nevertheless as the process evolves the limitations of the program start to overcame the benefits of using it. The amount of manual work needed to keep the tool updated is jeopardizing further improvement of input quality and integration of plans. Additionally this big amount of manual work makes the tool prone to errors. Finally the graphic display capability is limited and already at its maximum delaying the decision making process.

As said previously there are already some support tools in place to reduce the manual work in the process at this point. At this point they are used for resource planning. However some have the possibility to be upgraded and used effectively as a S&OP workbench. The suggestion is to choose one of these tools already in place and implement it in all the BUs, this is a long and expensive initiative but a necessary one to harvest the full range of benefits S&OP process can produce.

4.6.4 Next Steps for the S&OP process: Theoretical approach

In the following section some possible next steps for the S&OP process in order to achieve a higher stage in both of the maturity models used to evaluate the process throughout this paper.

Grimson&Pyke Model

- Meetings & Collaboration – The first concern in this parameter is to bring all of the BUs to the same level. Achieving this situation is only a matter of time since the processes are already in place. The lagging BUs just need to get familiar with the process in it self, and they will get to Stage 3. It is relevant to mention that the lagging BUs are the ones that less actively participated in the whole implementation process and therefore have less experience with the process. No specific actions is needed from the OP team besides the normal support given to the more advance BUs during their implementation process. Once this is achieved efforts should be focused in achieving Stage 4. However achieving Stage 4 is still far even for the most advanced BUs since this stage requires the input from clients and supplier, and so far the only input from these two groups as been marginal and coming only from major client

- Organization – At this point the S&OP process is in Stage 3 maturity in this parameter. As explained previously this is a organizational structure dependent variable therefore its up to management to make the decision to restructure the company. However considering that the S&OP process only started to be implemented recently and the big amount of structural changes the company as suffered in the recent past, the upgrade to Stage 4 should be put on hold at least until the rest of the process is more rooted into the company

- Measurements – This is the parameter in which less effort was done. No extra measurements were developed besides the standard financial metrics. To develop this type of metrics a big amount of data is necessary, since the measurements will be analyse the previous performance of the tool. Since the S&OP is so recent at this point, this data is not yet available and subsequently developing this type of extra metrics is cumbersome task. However once this data is available, the evolution of this parameter will be fast. Since the industry in which the company operates is project based, it is easy to assess sales accuracy. Therefore the evolution from Stage 2, where only the operational fit to sales is assessed, to Stage 3, where both operational fit and sales forecast accuracy is assess, will almost instantaneous.

- Information Technology – To achieve Stage 3 of in this parameter whole of the BUs should connect their IT resource management tool to the S&OP tool, more specifically to the OP part of the tool. This will increase the level of automation and make the consolidation part of the process easer. To achieve Stage 4 some extra IT programs needs to be implement. One of the requirements of this stage is a sales planning software, at this point no BU uses such a program and there is not any plans to acquire such a programme in the near future. A second requisite of this stage is a S&OP workbench IT tool. At this point the only available tool is the excel based spreadsheets, even if its use its optimized it will never allow a live cross-functional integration of plans. Therefore achieving a Stage 4 mutirity in this parameter is still far.

- S&OP Plan Integration – To achieve a Stage 3 maturity level in this parameter the process only needs to do a marginal improvement. At this point there is the necessary the necessary processes to include in the sales forecast inputs from the operational side. Operations team member present in the Sales Planning meeting will provide this input. Additionally the bottom-up approach is already employed when defining the plans therefore no improvement is needed is this parameter.

Lapide´s *"Four-Stage S&OP Process Maturity Model"*

- Meetings – To bring all of the BUs to the 3 Stage its necessary to increase the level of motivation of the participants. To achieve this the OP team can increase the level of engagement with the lagging of BU by keep helping them implementing the S&OP process. Achieving Stage 4 is, has explained by *Larry Lapide in his "Sales and operations Planning Part III: A Diagnostic Model"* , something that cannot be fully achieved since to hold only even-driven meetings imply that the support tool has the ability to constantly keep track of sales and operations in real-time.

- Process – To bring all of the BUs to Stage 2 of maturity the OP team only needs to help the implementation of the process in the lagging BUs since the necessary processes are already defined. When all BUs present have a Stage 2 level of maturity in this parameter, taking the next step will imply a shift from a sequential process to a simultaneous process. This means that every BU needs to be able to produce their operational plan in an independent from sales way. To achieve the use of other tools for operational planning need to be in place, and a further change in the business culture and an increased familiarity with the S&OP process needs to be achieved. The S&OP team will have to implement this tools and focus their efforts in instructing all of the BU further about in the S&OP process

- Technology **-** Firstly is necessary to the link the IT resource management tool in use in all of the BU to the S&OP process. This will increase the level of automation and enable the Bu to use this IT tool as a supply-planning tool in the S&OP process ambit. This will take the whole company to a Stage 2 level of maturity. To progress further in this parameter a full integration of supply and demand tools needs to be achieved. To do this firstly a demand planning tool needs to implemented in the all the BUs, and then connects it to the IT supply-planning tools in place. These cannot be achieved only by the S&OP team efforts, some IT tools will need to be bough.

Chapter 5, Conclusion

This section will have two sub-parts one where both theoretical and practical approaches are compared and a second one where the results of the implementation of the S&OP process are assessed.

5.1 Theoretical and practical approach

When comparing the practical steps conducted by the S&OP with the theoretical frameworks used in the literature review it is possible to see that both approaches follow a similar guideline. In other words the OP team´s actions during the development and implementation of the S&OP tool followed, unconsciously, the principles the current S&OP theory defines as the best practice.

An indication of this common guideline is the consistent increase in the evaluation of the maturity of the tool throughout the course of the paper. In the first evaluation the models assessed the S&OP process in place as a Stage1: "Marginal Process" and Stage 1: "No S&OP process". By the third and last evaluation, and after a steady increase in the maturity level of the S&OP process, the results were not similar. According to Lapide´s Model the S&OP was in average in Stage 2: "Rudimentary Process", when using the Grimson and Pyke model the maturity of the process is evaluated as above Stage 2: "Reactive". Indicating that the actions undertook by the OP team are theoretically increasing the level of maturity of the S&OP too.

Another sign of this common guideline is the commonalities between the next steps the OP team will take to evolve further the maturity of the S&OP tool and the suggestions the theoretical models give to improve further the implementation of the tool. The two practical initiatives that the OP team plans to implement do follow some of the suggestions given by the theoretical models. The "Measurement of the Process" practical activity will probably improve the "Measurements" dimension in the Grimson and Pyke model. The "New IT program for the S&OP process" not only is likely increase the maturity level of both the Lapide´s "Technology" dimension and the "Information

Technology” dimension but also influence the both the “Process” and the “S&OP plan integration” dimensions from the Lapide´s and Grimson and Pyke models, respectively.

5.2 Practical results of the S&OP process

In theoretical point of view the S&OP process is already implemented, presents a more than initial maturity and, therefore, should produce the necessary information for management to set capacity or sales profit optimization actions.

Regardless of the theoretical results, at this point the S&OP process was not able to produce enough information with the necessary accuracy to enable any type of optimization action by management. However, the nature of some of the new initiatives taken by some of the BUs in parallel to the S&OP suggest that S&OP is influencing the way of operating in the company. Therefore it is expectable that in a near future the process will start to produce the necessary information to allow management to harvest the full extent of the benefits this process can concede to the company.

BIBLIOGRAPHY

Bowersox, D.J., Closs, D.J. and Stank, T.P. 1999 – 21st Century Logistics: Making Supply Chain Integration a Reality, *Council of Logistics Management, Oak Brook, IL.*

Caceres, L., Barret, J. and Mooraj, H 2009 – Sales and Operations Planning: Transformation from Tradition: Industry Value Chain Strategies. *AMT Research, Boston, MA*

Cox, J.F., Blackstone, J,H. 2002 – APICS Dictonary, Tenth wd. APICS, Alexandria, VA, USA

Dwyer, J. 2000 - Box clever with Planning, *Works Management, Vol. 53 No. 4, 30-32*

Feng, Y., D'amours, S., 2008 - "The Value of sales and operations planning in oriented strand board industry with make-to-order manufacturing system: Cross funstional integration under deterministic demand and spot market recourse. *International Journal of Production Economics 115(1), 189-209*

Gregory, A., 1999 – Moving Forward in Harmony with S&OP. *Works Management, Vol 52 No 4, 34-37*

Grimson, J.A., Pyke D.F. 2007 – Sales and Operations planning: an exploratory study and framework. *International Journal of Logistics Management* 18 (3), 322-346

Hadaya P., Cassivi, L., 2007 – The role of joint collaboration planning actions in a demand-driven supply chain. *Industrial Management & Data Systems, Vol. 107 No. 7, 954-978*

Kruse, G,. 2004 – New wine in old bottles?. *IEE Manufacturing Engineers,* Vol. 83 No. 3, 48

Lapide, L. 2002 - New Development in Business Forecasting, *Journal of Business Forecasting Methods and Systems, Vol. 21 No.2, 11*

Lapide, L. 2004a - Sales and Operations Planning Part I: The Process. *The Journal of Business Forecasting Methods ans Ayatems, Vol 23 No 3, 17-19*

Lapide, L 2004b - Sales and Operations Planning Part II: Enabling Technology. *The Journal Business Forecasting, Vol. 23 No 4, 18-20*

Lapide, L.,2005 - Sales and Operations Planning Part III: A Diagnostic Model. *Journal of Business Forecasting 24 (1), 13- 16*

Mansfield, A, 2012 - Executive S&OP Implementation - Do It Right. *The International Journal of Applied Forecasting, Fall 2012. Available at online:* http://ssrn.com/abstract=2179207

McCormack, K. and Lockamy, A. 2005 – The impact of horizontal mechaninsms within sales and operations planning processes o supply chain integration and performance: a statistical study. *Proceedings of the 4th Global Conference in Business Economics, Oxford 25-28*

Olhager, J., Rudberg, M., and Wikner, J., 2001. - Long-term Capacity management: linking the perspectives from manufacturing strategy and sales and operations planning. *International Journal of Production Economics*, 69 (2), 215-225

Olhager, J. and Selldin, E. 2007 – Manufacturing planning and control approaches: market alignment and performance. *International Journal of Production Research, Vol. 45 No. 6, 1569-84*

Olivia, R., Watson, N., 2010- Cross-functional alignment in supply chain planning: a case of sales and operations planning. *Journal of Operations Management, Vol. 29, No 5, 343-348*

Rooney, C., Bangert, C. 2001 – High-Level Management control of the planning process. *Adhesives Age, Vol. 44No 10, 49*

Shapiro, B. P., 1977. – Can Marketing and manufacturing co-exist? *Harvard Business Review 55(5), 104-114*

Tavares Thomé A. M. et al 2011 - Sales and Operations planning: a research synthesis. *International Journal Production Economics Vol.138, 1-13*

Tavares Thomé A. M. et al 2012 – Sales and operations planning and the firm performance. *International Journal of productivity and Performance Management, Vol 61 Iss: 4, 359 - 381*

Wallace, T.,F., 2004 – Sales and Operations Planning – The How-To Handbook, 2nd ed,. T.F. Wallace & Company, Cincinnati, OH

Annexes

Annex 1 – Existing tool pictures

Regional Resource Plan

	2013												2014											
	Jan.	Feb.	March	April	May	June	July	August	Sept	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	August	Sept	Oct.	Nov.	Dec.
Booked																								
Project 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project 3	0,53	0,93	0,83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project 4	7,8	4,3	3,3	3,3	2,3	2,3	2,3	2,3	2,3	1,8	1,8	1,8	0	0	0	0	0	0	0	0	0	0	0	0
Project 5	4,1	4,1	3,9	1,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0	0	0	0	0	0	0	0	0	0	0	0
Project 6	22,5	22,5	21,5	21,2	20,7	19,7	13,7	13,7	11,7	11,7	10,7	10,7	1	1	0	0	0	0	0	0	0	0	0	0
Project 7	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1
Project 8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Project 9	3,3	2,1	1,1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project 10	2,6	1,2	0,9	0,4	0,4	0,4	0,4	0,2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project 11	5,38	5,38	5,38	4,38	4,38	4,38	4,38	4,38	4,38	4,38	4,38	4,38	0	0	0	0	0	0	0	0	0	0	0	0
Project 12	1	4,5	4,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project 13	1,7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project 14	4,5	6,5	4,2	2,9	2,1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project 15	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Project 16	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Project 17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Partsum	58,41	56,51	50,61	38,38	35,08	31,98	25,98	25,78	23,58	23,08	22,08	22,08	3	3	2	2	2	2	2	2	2	2	2	2
Budget Prospects																								
Budget Prospects 1	3,05	2,7	2,9	3,25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Budget Prospects 2	2,4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Budget Prospects 3	3,15	4,65	3,65	3,55	0,2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Budget Prospects 4	0	12	14,1	13	10,7	7,5	7,5	2,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Budget Prospects 5	0	5	10,9	14	11,2	14	9,9	7,6	1,1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Budget Prospects 6	0	0	0	0	10,1	13,3	11,9	11,7	11,9	9,1	0,4	0,4	0	0	0	0	0	0	0	0	0	0	0	0
Budget Prospects 7	0	1,9	2,3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Budget Prospects 8	0	0	16,25	17,05	17,45	14,85	10,05	10,05	9,55	9,55	9,55	9,55	3	3	0,5	0,5	0,5	0	0	0	0	0	0	0
Budget Prospects 9	0	0	0	9,7	13,7	11,6	11,4	11,9	9,6	0,2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Budget Prospects 10	0	0,4	1,3	0,3	0,2	0,2	0	1,5	1,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Budget Prospects 11	0	0,5	7,4	7,9	9,6	7,4	4,4	2,5	0,5	0,5	0,5	0,5	0	0	0	0	0	0	0	0	0	0	0	0
Budget Prospects 12	0	0	9,6	1,7	6,1	9,6	9	7,1	6,5	5,8	5,6	5,1	5,1	5,1	5,1	0	0	0	0	0	0	0	0	0
Budget Prospects 13	1,5	1,5	1,5	15,4	15,9	16	16	17	16,5	16,3	16,3	16,3	1,8	1,8	1,8	1,8	1,8	1,8	0	0	0	0	0	0
Budget Prospects 14	0	0	0	14,2	15,2	16,2	16,2	17,1	18,6	13	12,8	12,8	2	2	2	2	2	2	2	1	1	1	1	0
Budget Prospects 15	0	0	0	0	5,3	9,7	10,1	10,4	8,1	7	2,5	0	0	0	0	0	0	0	0	0	0	0	0	0
Budget Prospects 16	0	0	0	0	0	0	0	5	5	15,6	17	17	7	2	2	2	2	2	2	2	2	2	2	2
Budget Prospects 17	0	0	0	0	0	0	0	5	5	13,2	14,6	14,6	7	2	2	2	2	2	2	2	2	2	2	2
Budget Prospects 18	0	0	0	0	0	0	0	0	0	16,7	13,8	13,95	7,1	8	8	7,8	7,8	0,8	1,8	1,8	1,8	1,8	1,8	1,8
Budget Prospects 19	2,2	3,1	3	3	3	3	3	3	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Budget Prospects 20	3,4	3,4	0,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Budget Prospects 21	1	2,2	2,2	1,1	0,5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Partsum	16,7	37,35	75,6	105,15	119,15	123,35	109,45	112,35	94,85	107,95	94,05	91,2	33	23,9	21,4	16,1	16,1	8,6	7,8	6,8	6,8	6,8	6,8	5,8

Figure 5- Existing tool

63	**Resource Request Total**	**127,31**	**142,56**	**144,91**	**159,53**	**145,53**	**135,43**	**100,33**	**101,33**	**92,93**	**121,03**	**115,23**	**112,88**	**30,9**	**21,8**	**18,3**	**18,1**	**18,1**	**10,6**	**9,8**	**8,8**	**8,8**	**8,8**	**8,8**	**7,8**
64	Booked	57,61	51,21	45,41	33,38	30,08	25,98	25,98	25,78	23,58	23,08	22,08	22,08	3	3	2	2	2	2	2	2	2	2	2	2
65	Budget	69,7	91,35	99,5	126,15	115,45	109,45	74,35	75,55	69,35	97,95	93,15	90,8	27,9	18,8	16,3	16,1	16,1	8,6	7,8	6,8	6,8	6,8	6,8	5,8
66	*Not included for*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
67	**Actual Capacity Total**	**82,8**	**83,5**	**84**	**83**	**84,8**	**85,8**	**85,3**	**87,3**	**87,3**	**87,3**	**85,3**	**85,3**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**
68	Employees	55,8	56,5	57	56	57,8	58,8	58,3	60,3	60,3	60,3	58,3	58,3	4,7	4,7	4,7	4,7	4,7	4,7	4,7	4,7	4,7	4,7	4,7	4,7
69	Hire-ins	16	16	16	16	16	16	16	16	16	16	16	16	1	1	1	1	1	1	1	1	1	1	1	1
70	External	11	11	11	11	11	11	11	11	11	11	11	11	0	0	0	0	0	0	0	0	0	0	0	0
71	**Potential Revised Capacity Total**	**97,6**	**108,8**	**123,3**	**131,3**	**129,1**	**124,6**	**111,6**	**112,6**	**115,6**	**120,6**	**117,6**	**112,6**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**	**5,7**
72	Employees	1	2	2	7	7	7	7	7	10	10	12	12	0	0	0	0	0	0	0	0	0	0	0	0
73	Hire-ins	11,8	21,3	35,3	39,3	35,3	29,8	17,3	16,3	16,3	21,3	18,3	13,3	0	0	0	0	0	0	0	0	0	0	0	0
74	External	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0

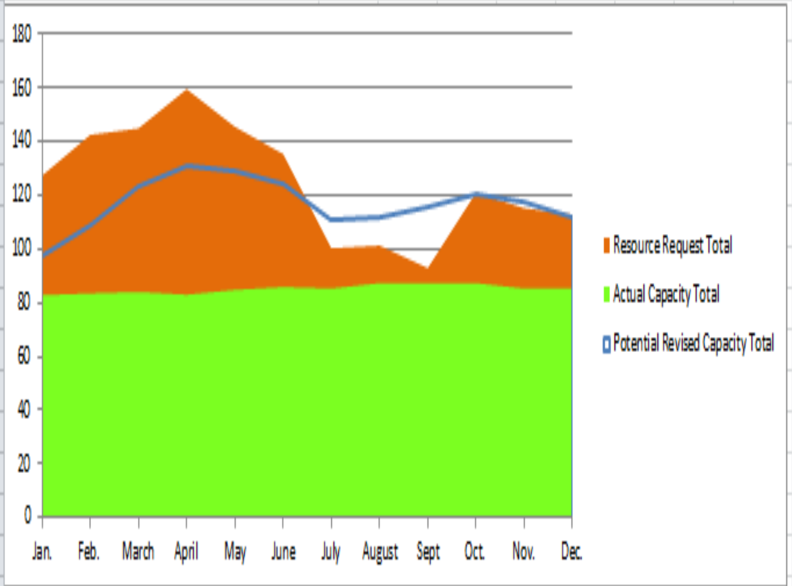

Figure 6 - Existing tool capacity display

Figure 7 - Existing tool set of disciplines

Annex 2 - Populated PRS Capacity tool

PRS Resource Plan

	2013											
	Jan.	Feb.	March	April	May	June	July	August	Sept	Oct.	Nov.	Dec.
AM												
Booked												
Priority Prospects												
Capacity												
Potential Capacity												
Partsum	0	0	0	0	0	0	0	0	0	0	0	0
BR												
Booked	12,62	10,20	23,88	35,54	34,12	30,09	28,01	21,94	20,04	20,15	19,74	19,70
Priority Projects	0,17	0,17	0,17	0,28	0,31	0,31	0,51	0,40	0,29	0,28	0,34	0,27
Capacity	26,00	26,00	25,00	25,00	25,00	25,00	25,00	25,00	25,00	25,00	25,00	25,00
Potential Capacity	26,00	26,00	25,00	25,00	25,00	25,00	25,00	25,00	25,00	25,00	25,00	25,00
Partsum												
EMEA												
Booked	19,43	15,74	14,54	13,47	11,03	8,73	7,85	6,87	4,77	4,24	1,70	1,55
Priority Projects	0,00	13,39	19,76	23,10	29,57	39,92	41,60	33,87	39,15	49,12	46,15	41,14
Capacity	63,50	63,50	63,50	63,50	63,50	63,50	63,50	63,50	63,50	63,50	63,50	63,50
Potential Capacity	63,50	63,50	63,50	63,50	63,50	63,50	63,50	63,50	63,50	63,50	63,50	63,50
Partsum												
AP												
Booked												
Priority Projects												
Capacity												
Potential Capacity												
Partsum												
NCS												
Booked	58,41	56,51	50,61	38,38	35,08	31,98	25,98	25,78	23,58	23,08	22,08	22,08
Priority Projects	16,7	37,35	75,6	105,15	119,15	123,35	109,45	112,35	94,85	107,95	94,05	91,2
Capacity	87,8	93,6	94,1	94,4	95,2	94,2	93,7	95,7	94,7	94,7	89,7	86,7
Potential Capacity	97,6	111,9	123,4	133,7	132,5	128	116	117	119	126	118	115
Partsum												
Resource Request Total	107,3255	133,3701	184,5607	215,9276	229,2612	234,3813	213,4047	201,2141	182,6789	204,8182	184,0631	175,9471
Booked	90,45502	82,45966	89,03177	87,39275	80,23329	70,79728	61,84554	54,58985	48,389	47,47187	43,51864	43,3307
Priority Projects	16,87045	50,91045	95,52892	128,5349	149,0279	163,584	151,5591	146,6243	134,2899	157,3463	140,5444	132,6164
Actual Capacity Total	177,3	183,1	182,6	182,9	183,7	182,7	182,2	184,2	183,2	183,2	178,2	175,2
Employees	0	0	0	0	0	0	0	0	0	0	0	0
Hire-ins	0	0	0	0	0	0	0	0	0	0	0	0
External	0	0	0	0	0	0	0	0	0	0	0	0
Potential Revised Capacity Total	187,1	201,4	211,9	222,2	221	216,5	204,5	205,5	207,5	214,5	206,5	203,5
Employees	0	0	0	0	0	0	0	0	0	0	0	0
Hire-ins	0	0	0	0	0	0	0	0	0	0	0	0
External	0	0	0	0	0	0	0	0	0	0	0	0

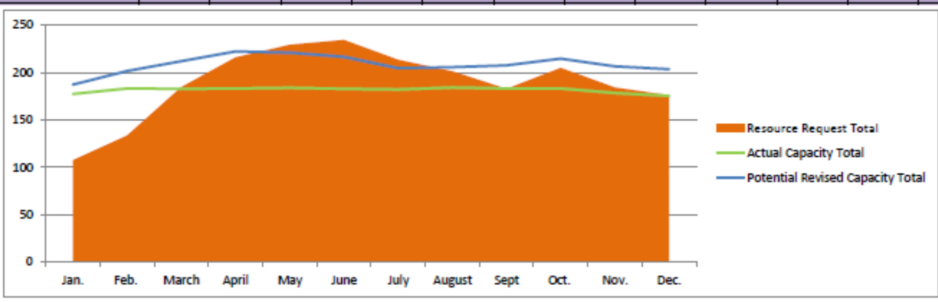

Figure 8 - Populated PRS Capacity tool

Annex 3 - First Draft of the S&OP Flowchart and New graphic display

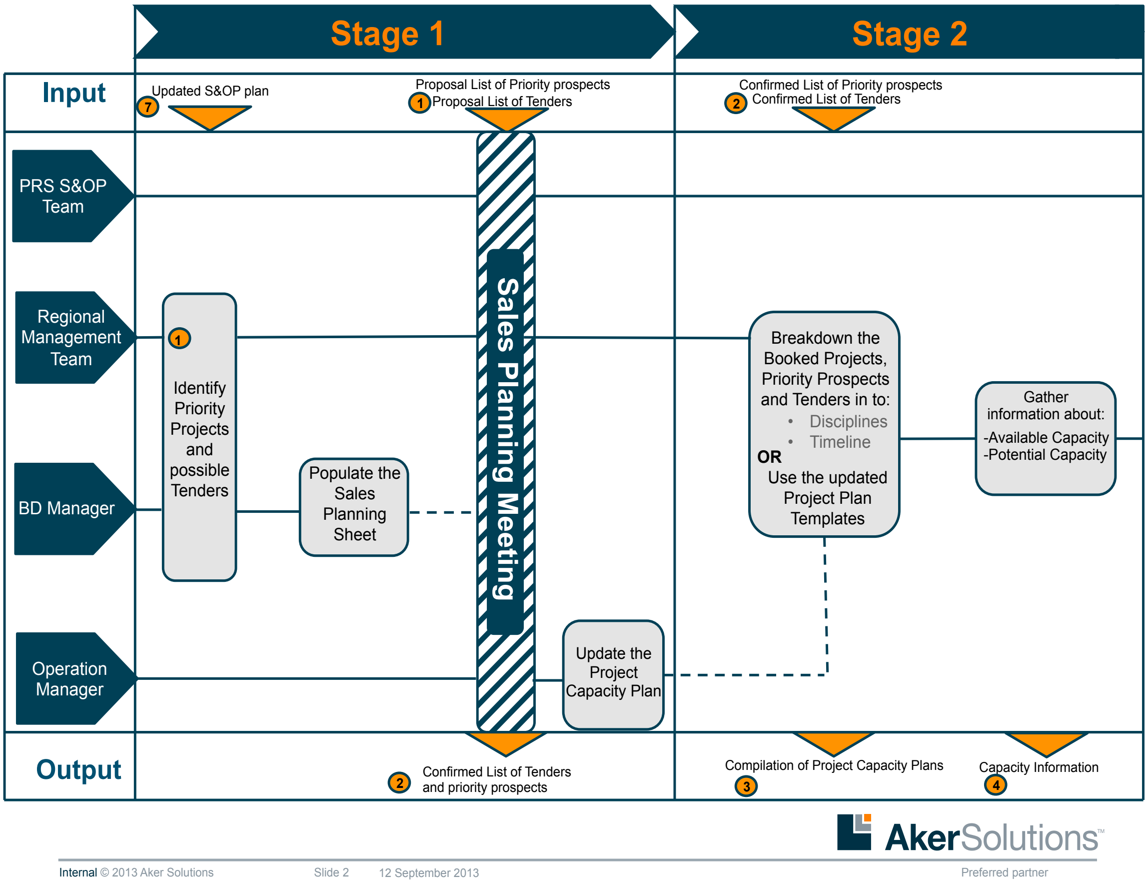

Figure 9 - Flowchart Stage 1

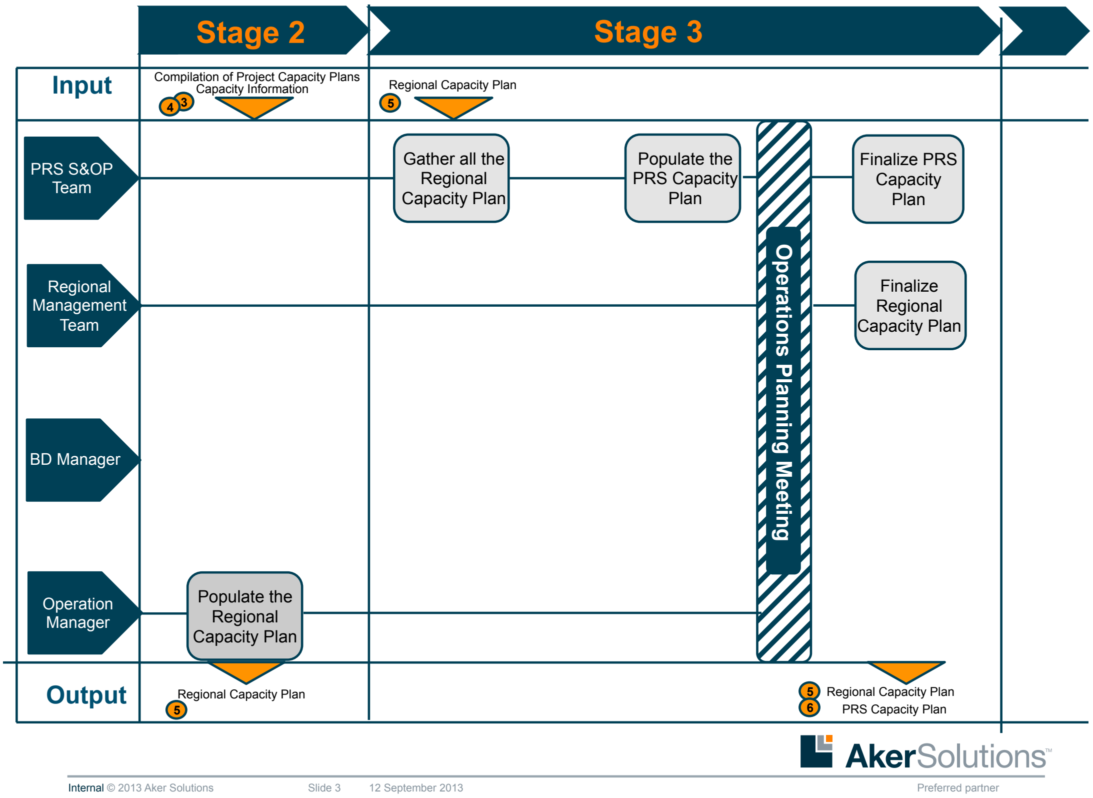

Figure 10 - Flowchart Stage 2 and 3

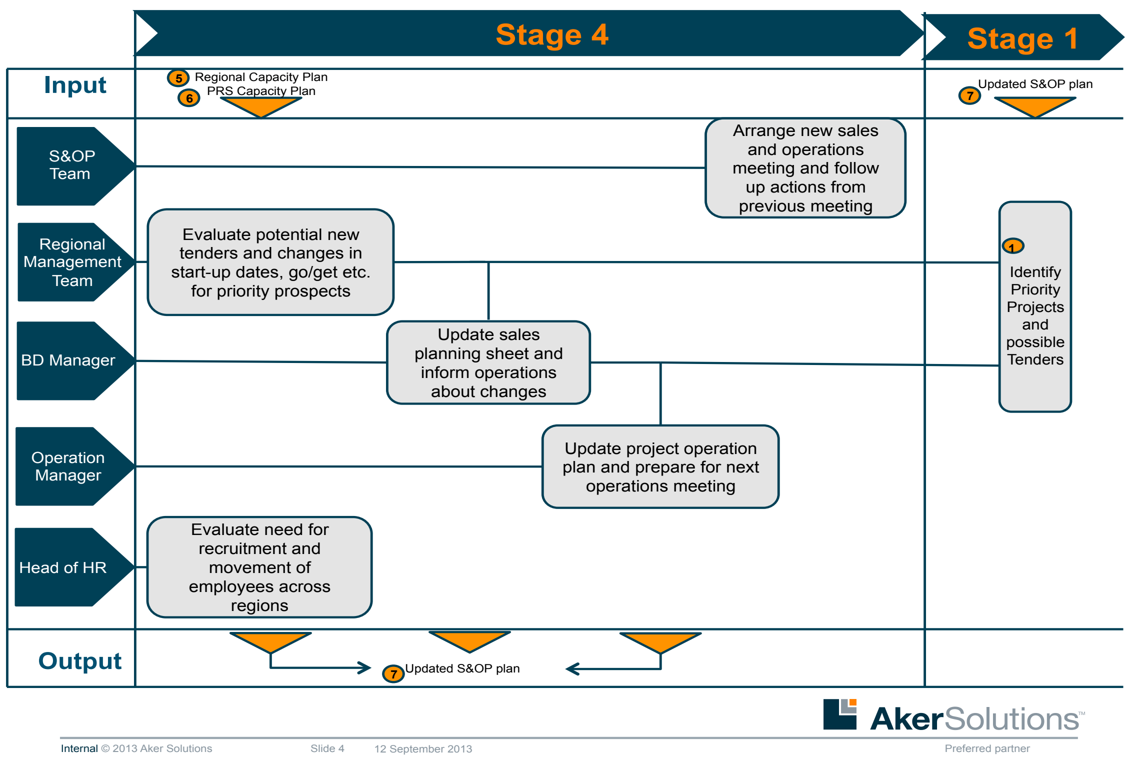

Figure 11 - Flowchart Stage 4

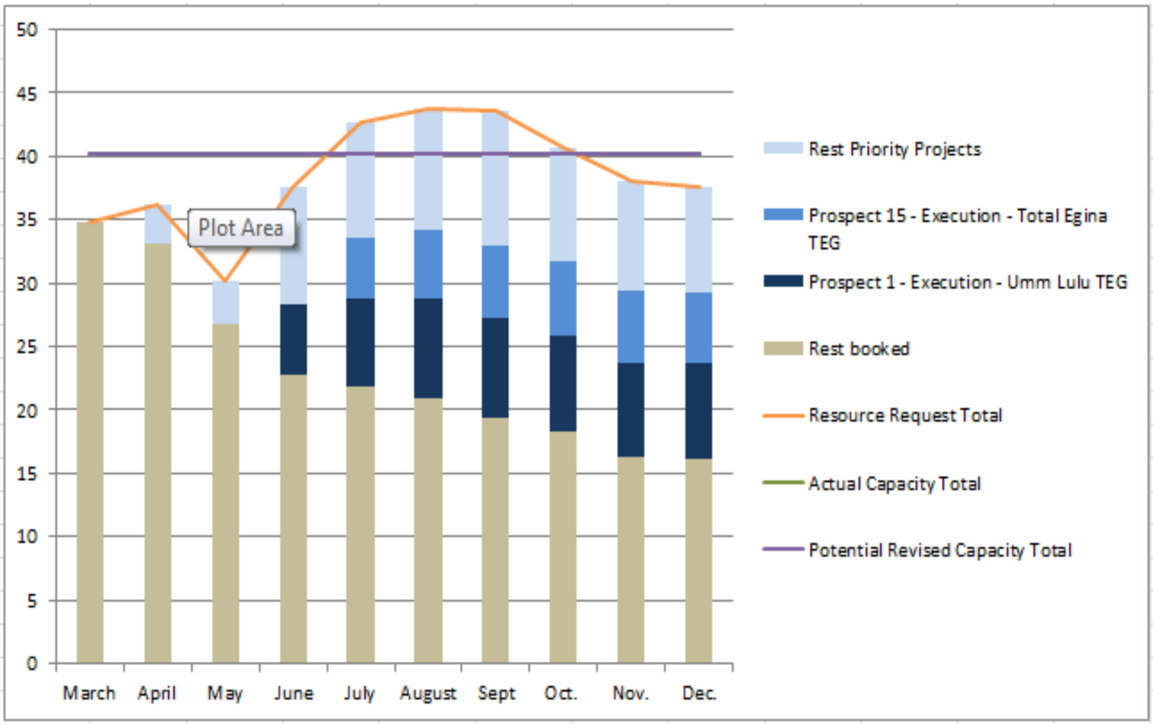

Figure 12 - New Graphic Display