

# Evaluation of Sales and Operations Planning Process Using Maturity Models-Case Study

**Oumaima Hansali, Samah Elrhanimi, Laila El Abbadi**

Laboratory of Engineering Sciences,  
National School of Applied Sciences, Ibn Tofail University.  
Kenitra, Morocco

[Oumaima.hansali@uit.ac.ma](mailto:Oumaima.hansali@uit.ac.ma), [elrhanimi.s@gmail.com](mailto:elrhanimi.s@gmail.com), [laila.elabbadi@uit.ac.ma](mailto:laila.elabbadi@uit.ac.ma)

## Abstract

Optimize inventory level, reduce the discrepancies in supply and demand and increase customer satisfaction are the most decisive key factors that impact significantly the overall performance and effectiveness of the firm. In this context, the concept of sales and operations planning (S&OP) was developed with the aim of supporting companies to improve their process, ensure operational flexibility and gain competitive advantage. This paper is intended to present a literature review of sales and operations planning covering the various maturity models developed in this field. A case study was included for the evaluation of S&OP process maturity in automotive manufacturing company using two selected models proposed by Grimson & Pyke (2007) and Wagner et al. (2014). The implementation of S&OP process in the studied company shows significant improvement in supply chain performance, resulted in a 17% improvement in forecast accuracy, 37.5% reduction in leftover stock and 17% improvement in delivery performance. In the last section, some gaps were identified and proposal for improvement was presented in order to advance the company maturity stage. The results of this study can be considered as a way to understand the different aspects of S&OP maturity models and provide guidance for researchers and practitioners in identifying gaps and opportunities for future research.

## Keywords

Supply chain, maturity model, S&OP, sales and operations planning, performance

## 1- Introduction

In the field of supply chain management, reducing inventory level and improving customer satisfaction become the most important goals for many companies due to the positive impact on supply chain performance improvement and efficiency of the firms (Thomé et al. 2012; Wagner et al. 2014; Vereecke et al. 2018). In this context, the concept of S&OP was developed with the aim to help companies improving their process, matching supply and demand and increase profitability (Thomé et al. 2012). The S&OP includes all process to establish the estimated production plan at the tactical level, linking the strategic objectives of the company with the operational issues of the production master plan to best balance the demand and offer (Feng et al. 2008). The implementation of S&OP is expected to lead to several benefits such as accurate forecast planning, match demand and supply, reduce obsolete stock and improve customer service level (Wagner et al. 2014; Muzumdar and Fontanella 2006; Thomé et al. 2012; Kristensen and Jonson 2018).

In this paper we start by reviewing the S&OP and maturity models presented in the literature followed by an overview of different maturity models developed in the field of S&OP. In the next section, a case study approach was conducted in automotive manufacturing company; the objective is to evaluate the S&OP process maturity using two maturity models. In the final section, we provide a comparison of the result and concluding comments.

## 2- Literature Review

### 2-1- S&OP Background

During the 1990s, the concept of S&OP gained more interest in many companies with the emergence of manufacturing resource planning (MRP II) and enterprise resources planning ERP systems (Olhager 2013; Thomé et al. 2012;

Vereecke et al. 2018; Sfinij and El abbadi 2020).the S&OP was defined as a dynamic process in which the company operating plan is updated on a regular monthly or more frequent basis ( Kristensen and Jonsson 2018).It represent a key tool to reduce barriers between company functions and ensure the linkage between operation, tactical and executive business unit while improving the visibility across hierarchies and functions (Tuomikangas and Kaipia 2014; Bagni and Marçola 2019).

The American Production and Inventory Control (APICS) defines S&OP as “A process to develop tactical plans that provide management the ability to strategically direct its businesses to achieve competitive advantage on a continuous basis by integrating customer-focused marketing plans for new and existing products with the management of the supply chain. The process brings together all the plans for the business (sales, marketing, development, manufacturing, sourcing, and financial) into one integrated set of plans. It is performed at least once a month and is reviewed by management at an aggregate (product family) level. The process must reconcile all supply, demand, and new product plans at both the detail and aggregate levels and tie to the business plan. It is the definitive statement of the company’s plans for the near to intermediate term, covering a horizon sufficient to plan for resources and to support the annual business planning process. Executed properly, the sales and operation planning process links the strategic plans for the business with its execution and reviews performance measurements for continuous improvement”. Source: APICS Dictionary, 2013, p. 154.

The S&OP process enclose 5 main steps: Data gathering, Demand planning, Supply planning, Pre-meeting and Executive meeting ,as shown in figure 1 (Wagner et al. 2014; Grimson and Pyke 2007; Hulthen et al. 2016; Kumar 2019).

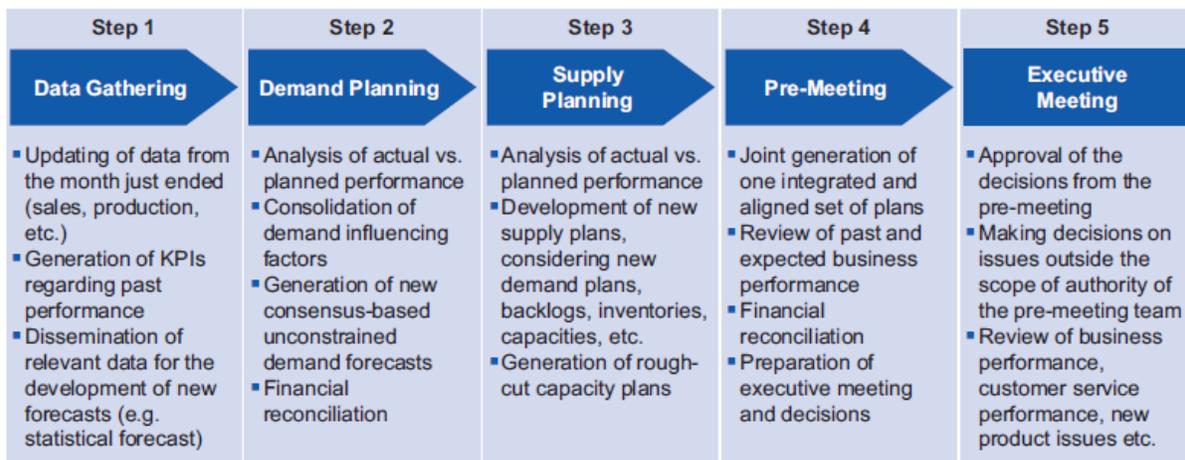


Figure1: S&OP process-Source: Wagner et al. (2014)

- Data gathering: consist of updating data on monthly basis, elaboration of main related key performance indicators and generation of reports requested for evaluation of past business performance (Wagner et al. 2014; Lapede 2004).
- Demand Planning: the horizon of minimum 12 months is considered for the data analysis shared in the precedent step; the forecast accuracy and planning assumption are reviewed and confirmed in this phase considering the financial aspect (Wagner et al. 2014).
- Supply Planning: the supply planning is ensured by operation level in the same time as demand planning, in this step, the constraints related to capacity, raw material availability, inventory level and backlog are considered for planning adjustment. Basically the rough cut capacity plan is generated automatically by MRP or by similar modules (Wagner et al. 2014).
- Pre-Meeting: a multidisciplinary team attends this meeting in order to review and validate the supply and demand plan, also to compare the actual performances against the business plan from financial point of view (Wagner et al. 2014).

- Executive meeting: in this meeting, the top management is invited to check inputs and approve the decisions from the pre-meeting. At this stage, the main crucial performance indicators are reviewed and strategic decisions are approved by the executive board. (Wagner et al. 2014).

## 2-2- S&OP maturity models

Although the positive impact of S&OP on the firm performance, several companies are struggling to get the expected benefits from S&OP implementation (Wagner et al. 2014; Goh and Eldridge 2019). In this context, the maturity models were developed in order to help companies evaluating the S&OP process maturity, identifying gaps and set improvement plan to overcome the difficulties and reach advanced S&OP maturity stage (Pedroso et al. 2017). We referred to Thomé et al. (2012) and Pedroso et al. (2017) for a comprehensive overview of S&OP maturity models.

The main maturity models which were developed in the field of S&OP are summarized in table1, where we identified the author(s), year of publication, number of levels and maturity levels name. The measured S&OP metrics in each model are shown in table2.

Table 1: S&OP maturity models overview

Author	Year	N° level	Maturity levels name						
			1	2	3	4	5	6	
Wing & Perry	2001	3	Integrated Planning solution	Collaboration with trade partners	Network hub solutions				
Lapide	2005	4	Marginal	Rudimentary	Classic	Ideal			
Ventana Research	2006	4	Tactical	Advanced	Strategic	Innovative			
Grimson & Pyke	2007	5	No S&OP	Reactive	Standard	Advanced	Proactive		
Feng et al.	2008	3	Decoupled plans	Partially Integrated plans	Integrated plans				
Viswanathan	2009	3	Best in class	Average	Laggards				
Cecere et al.	2009	4	Reactive	Anticipative	Collaborative	Orchestrate			
Wagner et al.	2014	6	Undeveloped	Rudimentary	Reactive	Consistent	Integrated	Proactive	
Goh & Eldridge	2015	5	No S&OP	Reactive	Standard	Advanced	Proactive		
Hulthén et al.	2016	5	No S&OP	Reactive	Standard	Advanced	Proactive		
Mendes Junior et al.	2016	6	Basic Push Operation	Optimized push	Hybrid push-pull	Advanced demand driven pull	Optimized demand-driven pull	Basic Push Operation	
Pedroso et al.	2017	5	Very low	Low	Medium	High	Very high		

Table 2: dimensions of S&OP maturity models

Author /Dimensions	IT	Meeting	Process	People	Performance management	Process Organization	Measurement	Plan integration	Decision making	Customer service	Cash conversion cycle	Cash flow	Market share	Profit	Forecast accuracy	Demand measures	Supply measures	Product life cycle
Wing & Perry (2001)	*																	
Lapide (2005)	*	*	*															
Ventana Research (2006)	*		*	*			*	*										
Grimson & Pyke (2007)	*	*	*			*	*	*										
Feng et al. (2008)								*										
Viswanathan (2009)										*	*				*			
Cecere et al. (2009)										*		*	*	*		*		
Wagner et al. (2014)	*	*	*	*		*	*											
Goh & Eldridge (2015)	*	*	*			*	*	*								*	*	
Hulthén et al. (2016)			*	*		*										*	*	
Mendes Junior et al. (2016)																*	*	*
Pedroso et al.(2017)	*			*		*	*	*										

These models vary in the number of maturity levels from three to six stages and in the dimensions that are being measured. We also noticed that several dimensions are commonly used in different maturity models. The figure 2 illustrates the number of models using the same dimension.

Figure 2 shows considerable usage of the dimensions “Technology”, “Process”, followed by “Organization”, “Measurement” and “Planning integration”, it justifies the importance to include these metrics in the assessment of S&OP maturity stage. For the case study presented in the next section, the emphasis is given to the two following models: Grimson and Pyke (2007) and Wagner et al. (2014), the reason is that both models include the main dimensions proposed by other models.

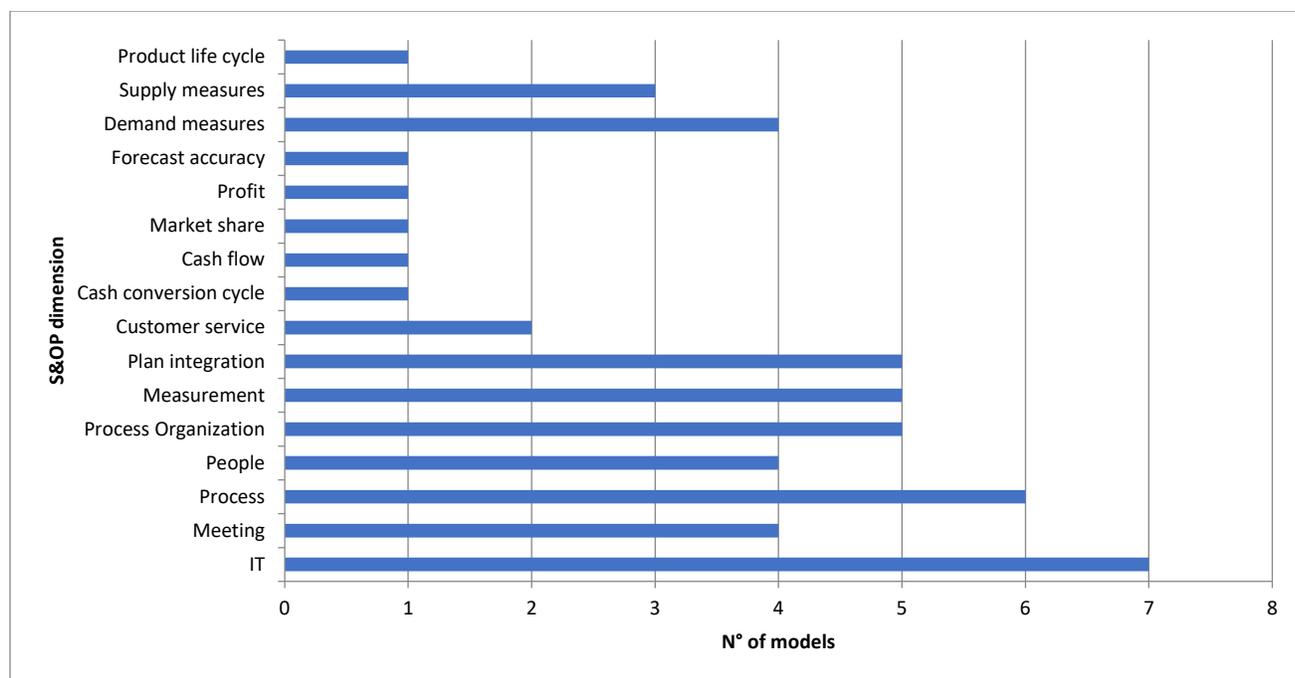


Figure2: Number of models per S&OP dimension

### 3- Case study:

A case study is conducted in automotive manufacturing company where the S&OP is implemented since mid of 2016. Through this study, we evaluated the degree of S&OP process maturity using two models namely: Grimson and Pyke (2007) and Wagner et al. (2014). From the measurement and classification performed, the existing gaps were identified followed by proposal for improvement in order to advance company’s position to more evolved S&OP stage.

#### 3-1- Methodology:

The data was collected through interviews with the supply chain manager and demand planner, the first part was related to basic data and company’s profile such as product family, supply chain network and production flow, we also investigate the company S&OP process to get clear picture regarding planning integration , demand forecasting and supply management , More detailed questions were focused on company’s S&OP program going through meeting calendar , team members , organization and key performance indicators. The S&OP interview template proposed by Grimson and Pyke (2007) was used as a guideline in our interview meeting.

#### 3-2- Company profile

Based on the interview meetings, we summarized the basic information related to the company in table 3.

Table3: Company basic information

<b>Industry</b>	<b>Automotive</b>
Strategy	Make to stock
N° of Product family	>500 item
N° of Suppliers	>50
N° of Customers	>100
ERP (Enterprise Resource Planning)	SAP software

Regarding the S&OP process in the company studied, it was formally implemented in mid of 2016 due to the necessity of balancing demand and supply, figure 3 illustrates the S&OP planning process.

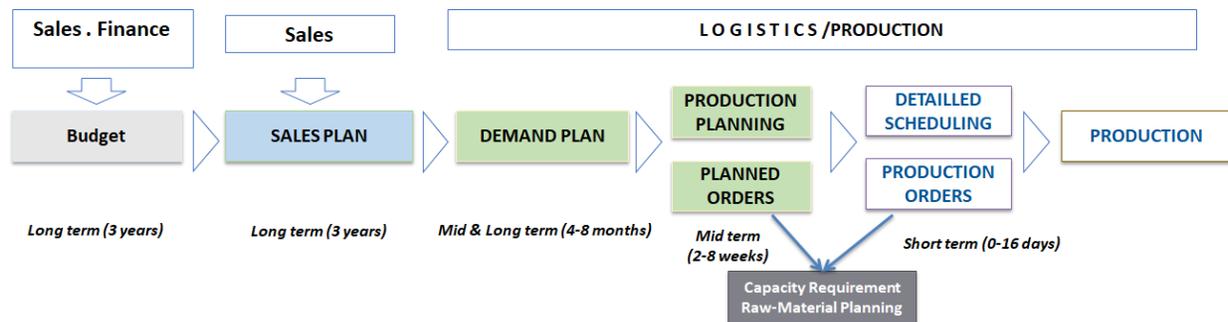


Figure3: S&OP Planning Process in company studied

**Budget:** Planned twice per year by sales/finance department considering the horizon of next 3 years based on OEM (Original Equipment Manufacturer) market figures. **Sales plan:** Planned on monthly level for each product family for horizon of next 3 years – based on customer forecast. **Demand plan:** planned on monthly basis for horizon of next 4-8 months based on several inputs ( historical data, statistical data, sales plan, customer orders ...). **Production planning:** the plan is fixed in short term based on firm orders, capacity constraints and stock level, triggering automatically the raw material and capacity requirement.

In table 4, we provided a comparison of 3 main key performance indicators related to supply chain in the studied company, before and after the S&OP implementation.

Table4: Key performance indicators- comparison before and after S&OP implementation

KPI( Key performance indicator)	2016	2020
MAPE(Mean absolute percentage error)-Forecast accuracy %	62%	80%
Obsolete stock value	200 k€	125 k€
Delivery performance %	70%	87%

This comparison demonstrates the considerable benefits of S&OP implementation, the delivery performance was increased by 17%, dead stock reduced by 75 k€ and improvement of forecast accuracy from 62% to 80%.

### 3-3- S&OP process maturity evaluation

The maturity models represent a key tool which help companies to assess the as-is situation and to focus on the areas of improvement in order to achieve the desirable maturity stage (McCormack et al. 2003).The two maturity models selected for this case study are respectively developed by Grimson and Pyke (2007) and Wagner (2017).

- **Maturity evaluation using Grimson & Pyke Model**

The framework elaborated by Grimson and Pyke (2007) contains five evolutionary levels: Without S&OP, S&OP Reactive, S&OP Standard, S&OP Advanced and S&OP Proactive. The stages are analyzed based on five dimensions: meetings and collaboration, organizational structure, measures of performance, information technology, and integrated planning (Grimson and Pyke 2007).

Regarding “**meeting and collaboration**” dimension, the company is in the standard stage considering that a pre-meeting is planned on monthly basis, attended by logistics, sales, operation team where demand and forecast data for horizon of 12 months are shared and reviewed, the next formal meeting is planned at the end of each month, all main

functions are participating in this meeting, supplier and customer data are shared, Besides, suppliers and customers are not involved in the S&OP process and not participating in this meeting.

In the dimension “**organization**”, the company is in Proactive level, since a formal S&OP team is defined, the team members are aware about the value of S&OP process and the positive impact on company success. Related to “**measurement**” dimension, the company is in standard level, the key performance indicators are well defined and reported on regular manner. The performance indicators are mainly related to inventories, customer service level and forecast accuracy. Although both aspect related to new product introduction and S&OP effectiveness are not included in the S&OP process.

For the dimensions “**information technology**”, this company is classed advanced stage, the S&OP optimization software is integrated with ERP, and additional automated tools are available for demand and capacity evaluation. In relation with “**plan integration**” dimension, the company is in standard level, the sales plan is considered as main driver for operation planning, in case of high customer demand fluctuations, the information is shared with sales team for review and planning adjustment. Nevertheless the capacity and operation constraints are not considered in the sales plan forecast, admitting that production should meet the customer demand. The maturity evaluation result based on Grimson and Pyke (2007) model is represented in table 5 and table 6.

Table5: S&OP maturity assessment using Grimson & Pyke (2007) model

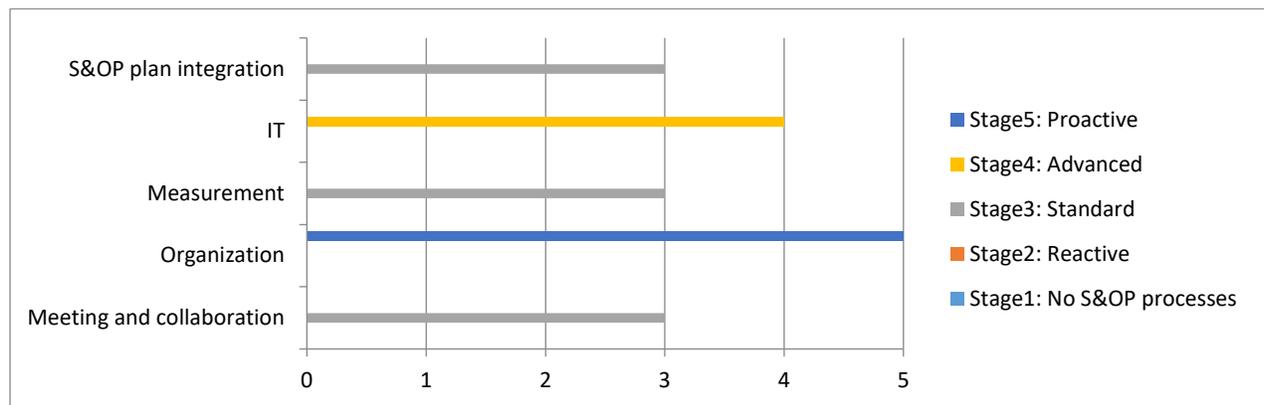
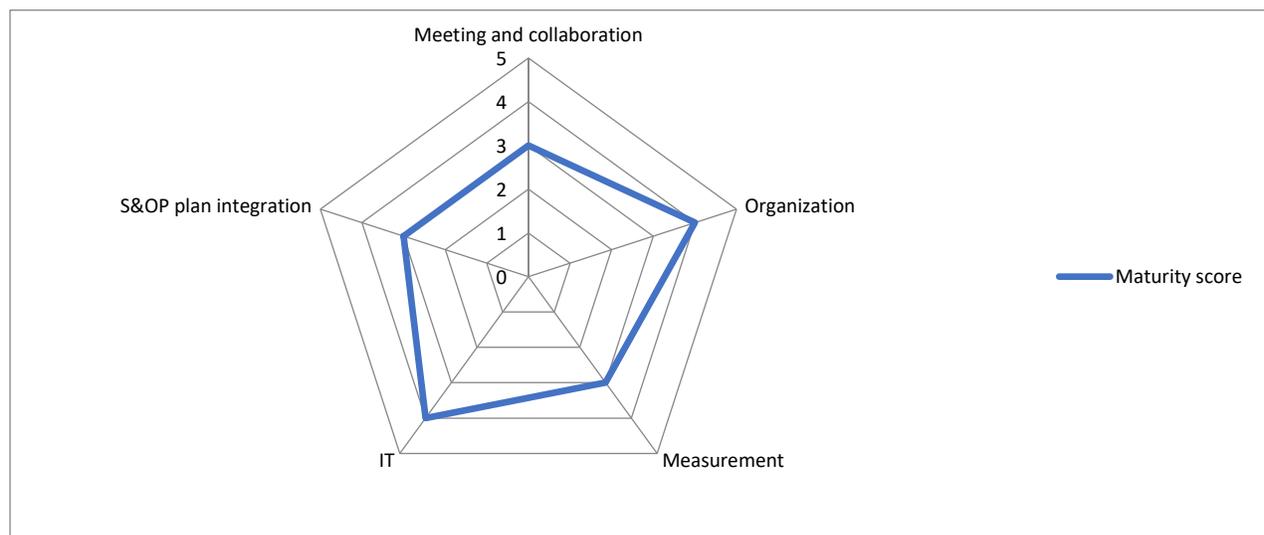


Table6: S&OP maturity assessment result using Grimson & Pyke (2007) model



Evaluating the S&OP metrics based on Grimson & Pyke (2007) model, the company is growing up from Standard to Advanced maturity stage with total average score of 3.4.

▪ **Maturity evaluation using Wagner Model**

The model developed by Wagner et al. (2014) consists of six maturity levels: underdeveloped; rudimentary; reactive; consistent; integrated and proactive. S&OP is evaluated according four dimensions: (i) process effectiveness that contains general characteristics and activities of the process; its sub-dimensions are: degree of formalization, scope, collaboration and alignment; (ii) process efficiency is related to plans integration and alignment, composed of three sub-dimensions: information preparation and sharing; meeting efficiency; and KPI measurement; (iii) people and organization (that is specifically directed to the two sub-dimensions: roles, responsibility and organizational structure; and knowledge, commitment, and executive sponsorship); (iv) and information technology (Wagner et al.2014).

Table7: S&OP maturity assessment using Wagner et al. (2014) model

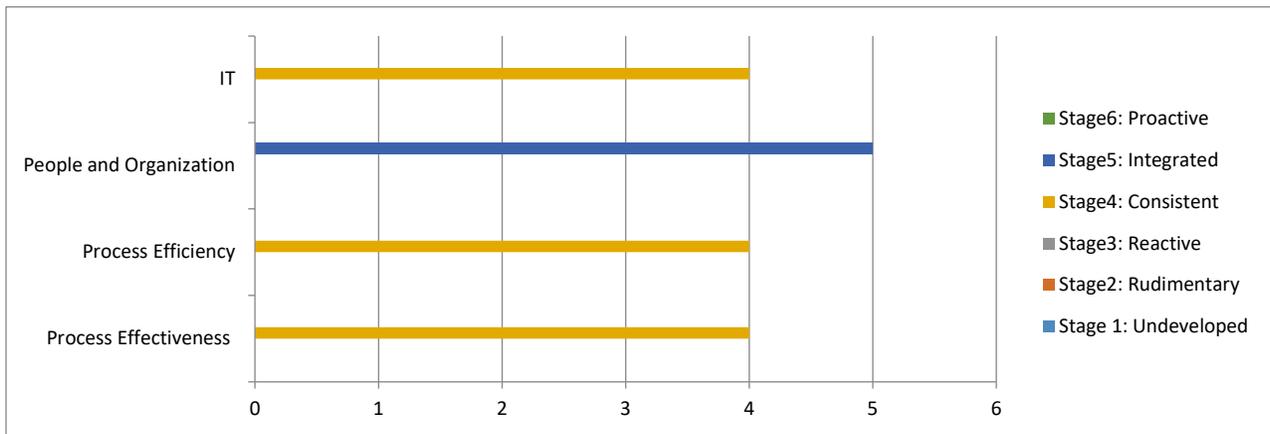
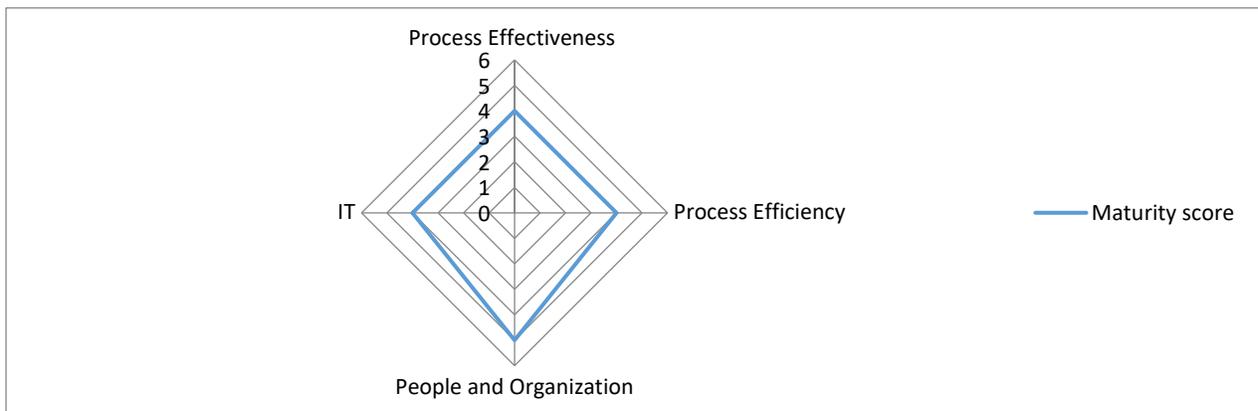


Table 8: S&OP maturity assessment result using Wagner et al. Model



For the dimensions of “**process effectiveness**”, the studied company is assessed in consistent stage since regular meeting is scheduled once per month where consistent data are available for all product families, a cross functional company team attends this meeting to align supply and demand plans. Regarding “**process efficiency**” dimension, the company is in same stage as the 1<sup>st</sup> dimension, all needed information are accessible for all departments and can be shared during the meeting using some advanced tools and dashboards , the key performance indicators for each departments are well defined and reported on weekly basis.

For “**people and organization**” dimension, the company is classed in integrated level, roles and responsibilities are clearly defined for each process owner, and the S&OP team is highly involved in the process and recognized the benefits of S&OP implementation. In the last dimensions “ **information technology**”, the company is in consistent stage , using SAP ERP for integrated planning and linked modules , providing accessibility for all planning data in real time , others tools are also available and linked with ERP supporting in data analysis and scenarios simulation. The maturity evaluation using Wagner et al. (2014) model is represented in table 7 and table 8.

Given the classification of the four dimensions, the company S&OP is moving up from consistent to integrated maturity stage with total average score of 4.25.

### **3-4- Comparison between Grimson and Wagner Model.**

In the overall, the result achieved using the two models are similar in term of S&OP maturity classification, this similarity is due to the fact that both models adopt conformable dimensions, although we noticed some differences comparing the two maturity models. The first distinction is related to the number of dimensions and stages, for Grimson and Pyke model ,they opted for five levels and five dimensions instead of six levels and four dimensions in Wagner model ,we also remarked the necessity of the integration of supply chain partner in the four dimensions of Wagner Model in order to achieve the highest advanced stage, Grimson and Pyke (2007) include this element of supply chain partner integration only in two dimensions : “meeting and collaboration “ and “ measurement”. Furthermore Wagner model brought up the master data management as a main factor to improve the maturity of “Information Technology” metric. Nevertheless, both models present a qualitative and subjective evaluation of S&OP maturity without any metrics values or numerical factors which help providing quantitative and certain information.

### **3-5- Proposal for improvement**

This evaluation provide the opportunity to assess the S&OP maturity level in the selected company and also to identify the gaps between current and next stages, in this context, below two recommendations are suggested to improve the S&OP maturity in the studied company.

- Integration of key suppliers and customers in S&OP process

The integration of supply chain partners in the S&OP process is a key metric to have close relationship with them and more transparency regarding demand figures, urgent deliveries and critical parts ,considering that more than one hundred customers and fifty suppliers are defined for the studied company , we suggest to involve only the key suppliers and customers which are mainly impacting the key performance indicators such as delivery performance, supplier /customer backlog and forecast accuracy. An example is related to the galvanic raw material impacted by long lead time of six months, the demand fluctuations and delay of galvanic raw material deliveries are impacting directly the inventories level and customer deliveries, therefore it’s highly recommended to involve this key supplier in the S&OP process.

- New Product Introduction

One of the crucial factors impacting the inventories and orders lead time is the management of new product introduction especially in the automotive industry characterized by volatile market demand. the studied company was confronted with low forecast accuracy for the new products and this is principally triggered by missing historical data which can generate over stocks in case of high demand plan or customer backlog due to unavailability of raw material and capacity reservation, for this reason we highly recommend the integration of NPI’s challenges in S&OP program , the aim is that all relevant parts are involved to align about new product launch phase ,in order to improve the forecast accuracy while limiting inventories and ensuring delivery lead times.

## **4- Conclusions, Limitations and Future Research Direction**

A mature S&OP process is a key element to ensure the profit optimization and increase supply chain performance. Accordingly, the concept of S&OP has gained growing interest by several authors and companies over the recent years. Through this study we provided a summary of different S&OP maturity models based on literature review. An

application of two maturity models proposed by Grimson and Pyke (2007) and Wagner et al. (2014) was conducted in automotive manufacturing company where S&OP is implemented since 2016. A detailed assessment of maturity stage was performed followed by comparison among the two models, next we identified which actions should be taken in order to jump up to the next maturity stage, these recommendations are related principally to the integration of key suppliers, customers and also the consideration of new products challenges in S&OP process. As with any study, there are limitations, the S&OP process was evaluated only for one selected company and the interviews were conducted with only two members of S&OP team, considering the small sample size; the results are providing an elementary vision. Our perspective for next research is to extend this study by exploring additional case studies and survey researches using different maturity models in order to validate data and come out with new opportunities related to the maturity of sales and operation planning.

## References

- Feng, Y., D'Amours, S., and Beauregard, R., The value of sales and operations planning in oriented strand board industry with make-to-order manufacturing system: Cross functional integration under deterministic demand and spot market recourse, *International Journal of Production Economics*, vol. 115, no. 1, pp. 189-209, 2008.
- Kristensen, J., Jonson, P., Context-based sales and operations planning (S&OP) research A literature review and future agenda, *International Journal of Physical Distribution & Logistics Management*, Vol.48, no.1, pp. 19-46, 2018.
- Blackstone, J.H., *APICS Dictionary*, 14<sup>th</sup> Edition. APICS, Chicago, USA, 2013.
- Thomé, A.M.T., Scavarda, L.F., Fernandez, N.S., Scavarda, A.J., Sales and operations planning: A research synthesis, *International Journal of Production Economics*, Vol. 138, pp. 1-13, 2012.
- Wagner, S.M., Ullrich, K.; K.R., Transchel, S., The game plan for aligning the organization, *Business Horizons*, Vol. 57, no. 2, pp. 189-201, 2014.
- Lapide, L., Sales and operations planning Part 1: the process, *The Journal of Business Forecasting*, vol. 23, no. 3, 2004.
- Pedroso, C.B., Calache, L.D.R., Lima Junior, F.R., Silva, A.L., Carpinetti, L.C.R., Proposal of a model for sales and operations planning (S&OP) maturity evaluation, *Production*, vol. 27, 2017.
- Grimson, J.A., Pyke, D.F., Sales and operations planning: an exploratory study and framework, *International Journal of Physical Distribution & Logistics Management*, vol. 18, no. 3, pp. 322-346, 2007.
- Lapide, L., SALES AND OPERATIONS PLANNING PART III: A DIAGNOSTIC MODEL, *THE JOURNAL OF BUSINESS FORECASTING*, vol. 24, no. 1, pp. 13-16, 2005.
- Vereecke, A., Vanderheyden, K., Baecke, P., Steendam, T.V., Mind the gap –Assessing maturity of demand planning, a cornerstone of S&OP, *International Journal of Operations & Production Management*, vol. 38, no. 8, pp. 1618-1639, 2018.
- Muzumdar, M., Fontanella, J., The secrets to S&OP success, *Supply Chain Management Review*, vol. 10, no. 3, pp. 34-41, 2006.
- Olhager, J., Evolution of operations planning and control: from production to supply chains, *International Journal of Production Research*, vol. 51, pp. 6836-6843, 2013.
- Bagni, G., Marçola, J. A., Evaluation of the maturity of the S&OP process for a written materials company: a case study, *Gestão & Produção*, vol. 26, 2019.
- Hulthen, H., Näslund, D., Norrman, A., Framework for measuring performance of the sales and operations planning process, *International Journal of Physical Distribution & Logistics Management*, vol. 46, no. 9, pp. 809-835, 2016.
- Ventana Research, Sales and operations planning: measuring maturity and opportunity for operational performance management, San Mateo: Ventana Research, 2006.
- Wing, L., & Perry, G., Toward twenty first century pharmaceutical sales and operations planning, *Pharmaceutical Technology*, vol. 25, no. 11, pp. 20-26, 2001.
- Viswanathan, N., Sales and operations planning: Integrate with Finance and Improve Revenue, *Aberdeen Group*, Boston, MA, USA, 2009.
- Cecere, L., Barrett, J., & Mooraj, H., Sales and operations planning: transformation from tradition. Industry value chain strategies, Boston: AMR Research, 2009.
- Goh, S.H., Eldridge, S., New product introduction and supplier integration in sales and operations planning, *International Journal of Physical Distribution & Logistics Management*, Vol. 45, no. 9/10, pp. 861 – 886, 2015.
- Mendes, P., Leal, J.E., Thomé, A.M.T., A maturity model for demand-driven supply chains in the consumer product goods industry, *International Journal of Production Economics*, vol. 179, pp. 153-165, 2016.

Kumar, G.P., Maturity Levels in Implementing S&OP Process – A Study of Indian Auto Component Manufacturers, *IPE Journal of Management*, vol. 9, no. 1, pp. 26-36, 2019.

Sfinij, Y., El abbadi, L., Supply Planning Through The Industrial Revolutions, *Proceedings of the International Conference on Industrial Engineering and Operations Management*, Detroit, Michigan, USA, August 10 - 14, 2020.

## **Biographie**

**Oumaima Hansali** is a PhD student at the Computer science, Logistics and Mathematics laboratory in the national school of applied sciences (ENSA-Kenitra), University Ibn Tofail, Morocco. She received her industrial engineering degree from the same school. Since 2017 she worked as a demand planner in the automotive industry. Her major interest lies in the area of demand management and supply chain performance.

**Samah Elrhanimi** is an assistant professor at the Higher School of Technology, Ibn Tofail University-Kenitra. She is an industrial engineer and a Ph.D. in industrial engineering and logistics with eight years of professional experience in maintenance and process engineering in the automotive field.

**Laila El Abbadi** received the B.S. degree in industrial engineering from Faculty of Sciences and Technologies (FST), Sidi Mohamed Ben Abdellah University, Fez, Morocco, in 2006; the M.S. degree in industrial management and the Ph.D. degree in computer science, modeling and quality, from Dhar El Mahraz Faculty of Sciences, Fez, Morocco, in 2008 and 2013, respectively. From 2009 to 2014, she was a part time professor at some Faculties of Sciences in Morocco. Since 2014, she is a Professor of industrial engineering, at the National School of Applied Sciences (ENSA), Ibn Tofail University, Kenitra, Morocco. Her research interests include, but not limited to the following areas: quality management, lean management and operations management.